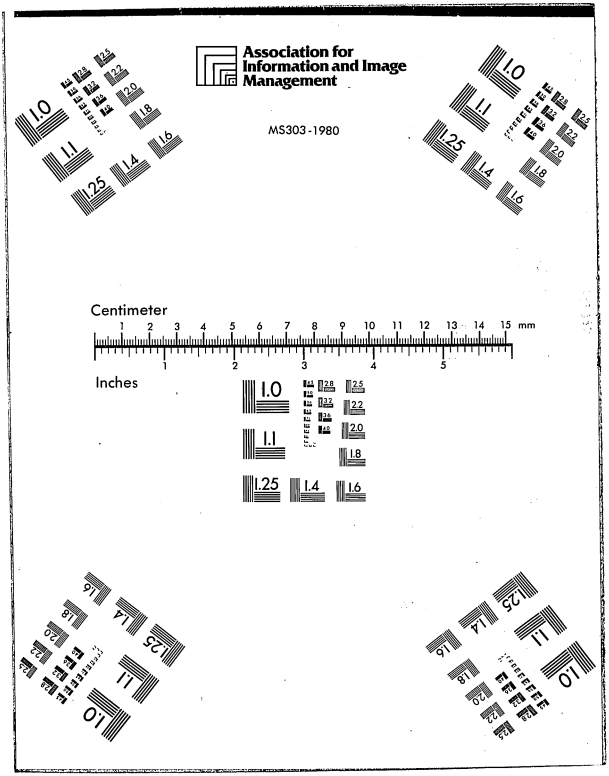
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A SELECTIVE MICROFILM EDITION

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(1879–1886)

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 91

SPECIAL COLLECTIONS SERIES (SPC-2)

Charles Batchelor Collection
Notebooks [continued]

Charles Batchelor Notebook, Cat. 1304

This notebook was used from November 1878 until the early 1890s. All of the entries are by Charles Batchelor. The first 73 pages cover the period November 1878-September 1879 and pertain to experiments on Gramme generators and magnetism, to the design of Edison's first generator, to filament coating and other lamp-related experiments, and to telephone experiments using the electromotograph. Pages 73-77 contain miscellaneous lamp and dynamo experiments recorded between 1884 and 1887. Beginning on page 78 there are a few dated entries from December 1890 and many undated entries from the 1890s relating to ore milling experiments, including notes taken from mining and scientific works about cadmium and palladium. The book contains 112 numbered pages. Pages 1-60 were numbered by Batchelor. The remaining pages were numbered by an archivist. Several pages have been cut out of the book.

Blank pages not filmed: 32-34, 87, 92-95, 99, 101-106.

1

N-75-11-17

Tuning fork. Nov 27th 1878 A

I find in a tuning fork with three prongs you can hold your finger in the middle in front opposite the other ones and if you start it by striking the middle one while one can afterwards stop the middle one without stopping the others.

96 ohz 96
96 2ohz 97½
96 ½ 2ohz

2 Nov 21st 1878.

Electric Light

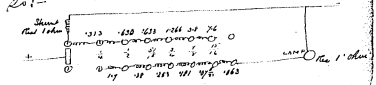
Sawyer-Man Light

1 Incandescence of Carbon in pure N

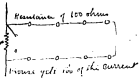
2 Uses a switch for passing or current gradually

same switch also divides the current between the lamp and ~~an equ~~ a resistance

Zoll—



Scientific American
Dec 7 1878.



He makes

1 It will constantly supply current (whether it is being used or not) to the same amount

2 If worked for quantity it would want enormous large conductors owing to the small resistance in each carbon

Chas F Batchelor

Induction Coils 2 Nov 28th 1848

It is well known that in some induction coils the intensity of the shock from the secondary is increased and decreased by pushing between the primary and secondary a brass tube. If this brass tube be split lengthwise this effect is not produced. This would tend to show that the currents flowing in the secondary are cut off and flow round the surface of the tube: and with a view to finding this out, I have constructed a number of experiments to try and take these currents from the tube.

with a device like sketched, I could get a very weak current not at in proportion to the energy that is given off when fine wire is used. A is a rod of iron wound with coarse copper wire one layer round which is put a sheet of copper almost touching, when the magnet is excited a current flows. I replaced the copper sheet with tubes of different metals and tried to take off a current from any part of it but took no better effect

Chas. Wheatstone

~~4~~ Nov 28th 1878

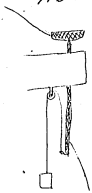
Batteries.

When $SO_3 H_2O$ is put in a jar and a piece of Zinc and copper placed one on each side inside, the SO_3 will attack the Zinc inside and eat it up rapidly, unless it does if the Zinc be taken out and rubbed with Mercury or amalgamated then put in again, it will not give off any H ~~unless a copper plate is attached~~ although when connected by wire to copper it gives just as much current as previous to amalgamation. Now

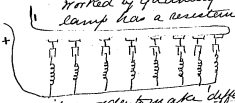
What influence does the Mercury have on the Zinc that it prevents rapid oxidation except when the circuit is established?

Electric Light J. Nov 30th 1898

Wenderman's system.



Worked by quantity each lamp has a resistance



also it is in order to make difference in pressure big & small for a whole circuit.

average resistance of each lamp & its resistance is 0.392 ohms

By the method 3 conductors are used

Now if Stewart building wanted 2000 lights on the plan what sort of a conductor would you have to have & take it 1000 feet & above?

By quantity if 1 lamp was 4 ohms

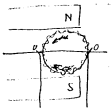
1000 lamp would be .0004

The wire called the 2000 feet long would be .0004 ohms resistance size of wire

But in this case he would in doubtful put about 20 lamps in each wire although you have to supply when nothing

6 Dec 9 1878

Gramme Machine



Imagine a N pole passing into a solenoid and its S to follow the current would be all in one direction.

As you pass the coil along the bar the current will be all same direction from X to X

It would be the same thing as putting ~~one~~ bar in one half way and then turning it round & putting it out of the other end

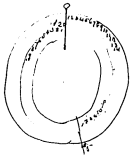
In Gramme armature the top half has a current running in one direction and bottom half a current in the other direction these meet at o o and the product is same as two batteries for quantity

Y

Dec 10 1898

Machine for Counting Change Chas Batchelor

When a store keeper receives $20 & has to take out $2.65 he wants to know just how much to give in return



One stationary outside disc running from 1¢ up to $20.00

One inside disc running same but in opposite direction

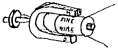
If you receive $5 & intend to take out $3.80 pull handle round to $5 and follow back to $3.80 & see what is marked on inside disc opposite it

Dec 15th 1918

Magneto Machine

See what sort of a current if any you can get from this arrangement a permanent magnet revolved rapidly inside a spool of wire

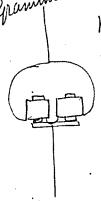
or: as:-



Drive a magnet round rapidly in between the pole pieces of an induction spool and see what current

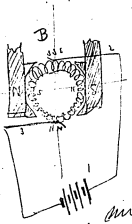
Dec 16th 1898.

Gramme Machine



Why does the Gramme machine run as fast by battery and have no dead point (apparently)? What is the action here

B is a Gramme M with commutators in place. When battery is put on at 1 it leads to form a N & S pole in the ring on each side with opposing poles. making one magnet in:—



When these are formed they are immediately attracted by the magnets and the field armature reaching so far round the core and the spring contacts covering more than one contact leave it so that it always will draw either one way or the other.

10

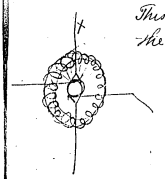
Gramme Machine

Dec 18 1878
Chas Batchelor

With Small gramme, with Jamin
Magnet a piece of Platinum
wire was heated red - 01 thick + twenty
(22 5/8 ~~two~~ and 5/8 inches long. 2.43 ohms
The Same can be done by eight
(8) large cells of Condit + Anson

Gramme Machine Dec 18th 1880 Chatpatcheur

In this machine Edison proposed an improvement: He claims that if Gramme would take off his armature & cut out all the coil but the sections he uses, by commutators, he would get a better effect from the machine. He would lessen his resistance & would lessen his resistance & he thinks get the same force. I made an experiment to try this by holding two pieces wire in the shape of ⌀ over the top and bottom of this dead short circuiting 2/3 of the coil



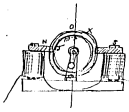
This device actually slows the speed. Not so good

12 Dec 19th 1878

Chas Batchelor

Magneto Electric Machines

In a magneto Electric machine in which there is used a ring of iron for armature & being revolved at a great speed the poles induced in the armature are not stationary as has been supposed but are carried round by the rotation so as to be strong across its opposite diameter as:—



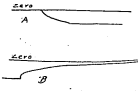
X is a round ring of iron on a shaft placed between the poles of a magnet very close without touching. now when the battery is on the magnet there is no magnetism at O but when the ring is revolved rapidly it makes a strong pole at O and also strengthens the pole in ring at J.

That is: instead of the induced pole in magnetised ring remaining still it is carried round by rotation.

18

Dec 19th 1874.
Chas Batchelor.

Heat in Spiral.



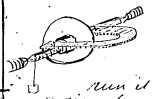
A Platinum spiral is heated up to incandescence by battery

In taking heat it seems to increase in about the same ratio but in decreasing it loses very rapidly at first, and gradually tails out as in fig B. in order to determine these curves exactly, I made a platinum wire with lever mounted and tinted about a foot long this, as the rod expanded and contracted allowed the marking on smoked glass of the curves due to increase and decrease of the heat and it showed as that Fig A is proportional and B the cooling are very much out of proportion.

This I think may be explained by the fact that when a body is heated to 900° Fah. it radiates at that rate and when at 2000° at 2000 rate so that when it begins to cool by it begins at the rate of 2000 and gradually comes to 100. It takes as long to radiate 100 at the temp as 900 at 1000 temp.

Dec 20th 1898
Chas Batchelor

Friction.



Experiment of the lifting power of magnetism.

I took a shaft and put a wheel on the middle, and run it between centres. I then took a given length of thread and weight; winding the thread on shaft and letting it go I timed its length of running with stop watch.

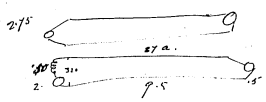
First magnet used would just lift the weight of shaft when out.

Second magnet was very strong being 4 together.

Result

Shaft alone being mean of 10 times	7·75 sec.
First magnet {close as possible to shaft mean of 10 times}	9·95
Second magnet ⅙ from core, this lifted the shaft up in its bearings	10·00
Second Magnet ⅓ met from core	11·00
Second Magnet ½ met from core	11·25
Second Magnet ⅔ from core at this place the shaft could either be lifted up to top of bearing or put to bottom	20·75

Showing a gain over shaft alone in the proportion of 7·75 to 20·75



$\frac{620}{12} = 51$ a.

$9.5 + 2.5$

$\frac{14.25}{480} + 135$

$\frac{620}{485}$ V
135

Dec 22d 1878
Chas Batchelor

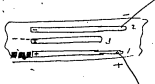
Electromotograph.

In the electromotograph action it would seem that if you laid two pieces of platina on the paper and passed the current through them the paper between the metals should be slippy near one and rough near the other. This however is not the case as I could not perceive it with great battery

 Dec 25 · 1898

Electromotograph —

Phenomenon !!!



on a strip of chemical paper when three pens are placed along side of each other and battery put through the two outside ones so that the marks appear at the No 1, then the middle spring will make a thin mark on the side furthest away as seen in sketch the explanation being

1 anything in between the two conductors becomes electrified & so makes one side of spring − & the other positive or else which I think is most likely

2 the width of the pen makes a short circuit for the current and of course it marks when leaving, but why does it only mark right on the edge?

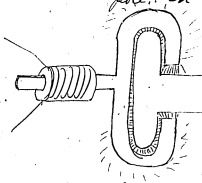
14

Dec 25th 1878.

Chas Batchelor

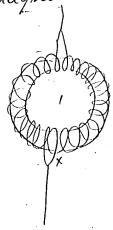
Magnets =

Armature entirely inside one pole. In this ~~[illegible]~~ experiment the lines of force are cut all round the armature sharp showing that if a magnet were made on this principle it would be cutting the greatest (possibly) number of lines of force that can be done



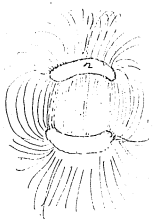
Magnets

Dec 25 1878
Chas Batchelor



A ring of iron wound continuously with one wire round in one direction and the two ends connected together for one wire and a wire connected at X for the other.

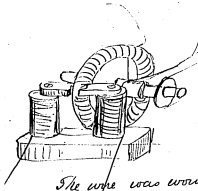
With a battery on the wire the lines of force appear as in ?



This should be same as the Gramme ring

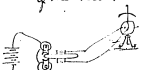
Dec 25th 1878

Magnetic Electric Generator — Chas Batchelder



Made a generator with 8 layers 20 silk Cov. wire on a 4 inch ring with fixed magnets placed in sides 21.

The wire was wound continuously in one direction for three layers and the two ends brought to copper rings on each side of the hub. The magnets were connected to 4 cells battery and to the Commutator spring

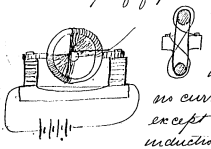


to a Thompson reflecting galvanometer; when the wheel was revolved rapidly in either direction, no current could be detected in the galv. because an equal and opposite current was set up in in each side of the same convolution neutralizing each other

Dec 26th 1878

Magnets Electric Machines.

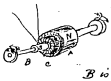
When the ring was wound in the shape of figure 8 and the ends brought each to a copper ring on the shaft and the commutators connected to a Thompson Galv, no current could be detected except the current due to induction on passing it in front of the pole.



Dec 27th, 1878.
Chas Batchelor

Magnets Electric Machines

I made a machine in this plan.



A is a cylinder of iron revolving in the direction of the arrow on its end this is polarized N by an electromagnet

B is a smaller cylinder of iron revolving in the opposite direction and polarized S by the same electromagnet, B runs inside A and between both is placed a ring of iron wound with 3 layers of 28 wire; this ring is stationary and B revolves inside and A outside of it. No current could be detected from this. The ring was now wound with 1 layer wound in shape of fig 8. B

22

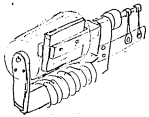
Dec 27 1878.
Chas H Batchelor

Electromotograph.

Fig

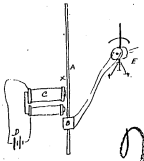
23

Dec 29th 1917
Chas Batchelor



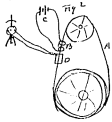
24 Dec 29th 1878
Chas Batchelor

Induction



C is an electromagnet excited by D battery
A is an iron rod running loose through a spool B.
when the rod is pulled through the spool the galvanometer E gives a deflection in one direction till the end of the iron comes to the point X and then on further drawing it out it reverses the current.

31



We then tried this:- Fig 2
A is an iron wire round two wheels
B is revolving magnet acts D is the spool that wire runs through, when the wire is running through fast or slow there is no deflection.

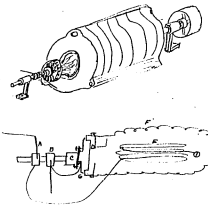
25

Jan 2nd 1879

Chas Batchelor

Edisons
Magnets Electric Mach

Have begun to make a peractical working machine after a few weeks hard study on magnets electric principles.

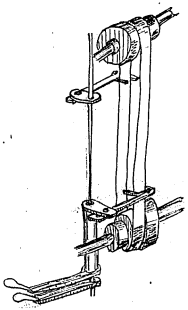


Feb 15 1879

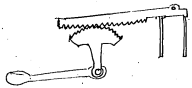
We have not been able to take off these currents as yet as the pull on the shell has ruptured the wire and we were obliged to cut it up.

Lathe belt Shipper 26 Jan 22nd 1879

Chas Batchelor



This is a device for shipping the belt of lead running on other belts



Electric Light 27 Jan 23rd 1879
Nickel Chas Batchelor.

Nickel stands better or as good as platinum for the light

Pure nickel. I took a piece 2½ mm square and 7 mm. long and rolled it down to 2½ mm wide and ·001 thick, annealing it each time of rolling, and whilst it would hold the heat. I rolled it hot: in this manner I brought it to ·003 in thickness before I noticed the characteristic cracking of its edges.

Fusing point Nickel 1500° C = 2732 F
" " Iron 1050° C = 1922 F

I took in Hessian crucible a small bit of Nickel but could not melt it in our furnace whilst with cast iron turnings I could melt comparatively easy

Uses of Nickel :—
German Silver Copper 100 Zinc 61 Nickel 40

28 Jan 23 1919
Chas Batchelor

Nickel

Uses:- Nickel plating :-
:- Coin 10 per cent in of nickel

Hardening Nickel.

Nickel heated to any temperature below fusing and then plunged in Water, or in Salt and water does not make it harder or softer

I took a piece of pure nickel and by continually heating it in the O & H blowpipe I was able to forge a piece that we was able to draw very easily

29 Feb 1st 1849
Chas Satchels

Silicon

Graphitoidal Silicon is a conductor of Electricity I made some in the following manner.

10 lbs Cryolite (Fl Al + Na.)
8 lbs ~~Silicate Soda~~
1 lb Aluminium

fused together and the resulting button of Al. treated with HCl + HF & free of entirely from Al leaves Silicon in graphite looking scales

20 oz. Cryolite
10 oz. Sil. Soda
2 oz. Al.
} made grains Si.

30. Feby 4th 1849

Carbons for Electric Light

Chas Batchelor

In making carbons such as are made by Carré of France I have found that a good way is to make paper moulds

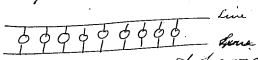
so, as long as necessary and then fill it with a mixture of Pound Coke, animal charcoal and Syrup. Took a device like this:-

a cylinder and ram in which when the syrup is placed, and the ram pressed down it is forced out of the little tube into the paper mould which is placed over it. These are afterwards dried slowly then heated to redness in sand they are then

Feb 1st 1879
Chas Batchelor

Electric Light.

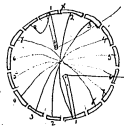
In working a central station where you have a number of magnets made in multiple arc thus:-



It would be necessary to provide a cut out for any machine that stops as if it stopped and was not cut out the others would make current through it and burn it up

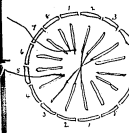
Feb. 15th 1899
Chas. Batchelor

Magnetic Electric Machine

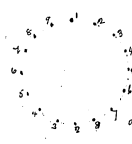


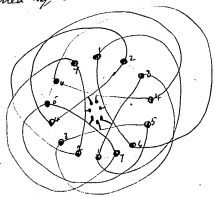
On page 25. is described a magnetic electric machine which is now finished, and to which the coils 1 & 2 etc are connected up as shown in sketch with 2 commutator springs & take off the currents

This is all short circuited in the machine. Very large spark at X



By connecting commutator springs as in this sketch we get lots of current although it is high tension owing to having in 4 coils or 80 ohms. It readily heats iron wire in 2 feet lengths even when turned by hand





96.

Feb. 14. 1879
Chas. Batchelor

Aluminum (process of getting out)

Why should Al be so dear when there are so many earths bearing an enormous percentage of it? Evidently its difficulty of separation. If a process could be devised whereby it could be smelted like or similar to iron it would be a big thing

Feb. 16 1879
Chas Batchelor

Wanted.

1 - Process for smelting Aluminium
2 - Solvent for Hard Rubber chips.
3 - Process for tempering Copper.
4 - Device some means whereby the magnetism of a permanent magnet can be weakened and replaced again by the Earth's magnetism.
5 - Make a machine (small) that a telegraph line repaired can carry, for twisting up the two ends of the wire

6

Feb 29th 1849

Chat Batchelor

Resistance of Metals at different heats

Our experiments show that Platinum increases its resistance between the ordinary temperature and brilliant incandescence only (3) three times.

Platinum Iridium alloy (Ir 2 Pt) increases nearly 4 four times.

Iron in vacuo and covered with acetate of magnesia to make it bear greater heat increases its resistance (15) fifteen times or more.

Feb 29 1879
Chas Batchelor

Iron Wire

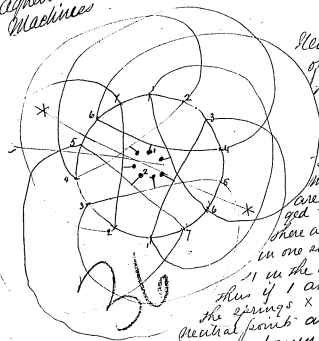
If we draw softened iron wire through the fingers it appears to be made up of innumerable joints.

If we heat it with the current and let it cool in cooling and contracting it will give a kind of a jump.

Sometimes when heating it I can plainly hear crackling noises both when heating up and when cooling due no doubt to expansion and contraction.

Feb 23 1879
Chas Batchelor

Magnetic Electric Machines



New method of connecting the shell in Edison's new machine. The commutators are so arranged that there are 3 one in one side and 1 in the other thus if 1 and 12 are the springs X X are the neutral points and all currents in one above X X are passing in the same direction and all currents below X X are in the opposite direction

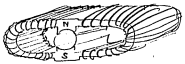
In each case as the springs are rotated we block the connections are changed and another construction is made having always like small drawing 3 ends on one side and 4 on the other. Any odd number of ends may be connected up this way.

Magnets Electric Machines

41

March 8th 1879
Charlottesville

We made a magnets Electric machine with field magnets so:— and the armature wound with 25 coils and connected as shown at P. 40. The armature was only 2 inch diameter. With a battery on it to drive it, it ran very fast and when turned it generated a current about equal to 4 Callaud cells



Mch. 10 1879
Char Batchelor

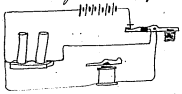
Magnets. Induction

If you want the magnet that will be changed on a given battery take the one that gives the greatest induction spark as that is the exact equivalent of the energy absorbed. (I mean the inductive discharge is which is shown almost entirely by the spark.)

If you want the greatest spark from given battery use the longest core magnet that the coil will cover and do not close it with armature, for although there is more inductive discharge from a closed magnet or ring than from an open one, yet the spark is not as strong, as it takes longer to discharge, and is more spread out

This could be made useful where they light gas by spark from small battery.

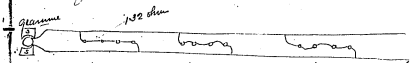
Method of showing discharge on a sounder



Electric Light 43 March 15th 1879
Chas Batchelor

This evening we lit our shop up with 12 spirals giving each about 22 candles from a Gramme machine running 960 revolutions and taking about 2 horse power. The spirals were Plat. Iridium 2% & and were 96 long and ·080 thick having a surface of 3/16 square inch, resistance of machine ·1 ohm; resistance of each spiral ·33 ohm.

They were put in multiple arc four in each arc thus:-



Total outside resistance ·44 ohm
" " & inside mach. 1·44 ohm

We find also that we can put resistance in equal to 12 lamps more.

March 23 1879
Chas Bartelot.

Platinum or Plat. Iridium wire can be coated by an insulator which will stand heat I have coated wires thirty inches long with a coating ·001 thick of Acetate of Magnesia and wound two layers on a lime bobbin, bringing the wire up to incandescence afterwards without fear of burning.
I have used for this purpose:-

Acetate of Magnesia
Acetate of Lime
Oxalate of Cerium

Just dampening the fingers with the solution and afterwards rubbing it on the wire and passing it through a candle flame to make it cake or harden. I find that the coating breaks off a little when brought up to incandescence after winding on the spool owing I suppose to the short turns on the spool but I can fix that very easily (and I do so) by covering it to ·010 thick and then coiling it up not less than 2 inches in diameter and bringing it to incandescence in a vacuum.

the result of which is to meet the magnesia down to a hard glassy mass on the wire which does not crack when wound on the spool only ¼ inch diameter but seems perfectly homogeneous under the microscope. In all the solutions so far tried the acetate of magnesia is by far the best but I believe the magnesia attacks the platinum slightly and if we could get an oxide of Cerium or Zirconium on it would be much better, Cerium however is very difficult to put on

April 24th 1919 46

Wire twisting machine

If a cheap way of fastening two line wires together could be devised it would be valuable

Machine must

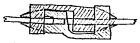
Hold the middle and twist both ends opposite

or Hold one end and twist all one way

or Hold both ends and twist in the middle

or Hold both ends and revolve with wire

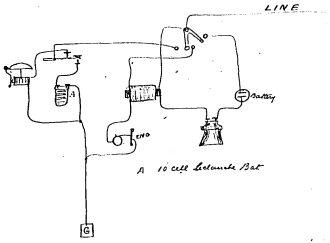
or the two ends might be locked together so as that when the wire pulled it would bind tighter —

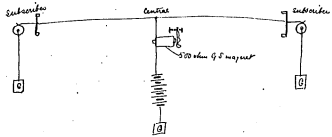


Edison's
Telephone.

May 1st 1879 47

Central System Instrument connections



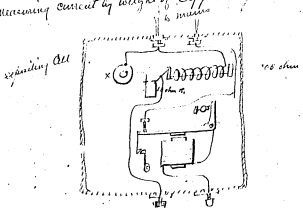


Electric Light. May 1st 1879 W.S.

Charles Batchelor

Force Meter.

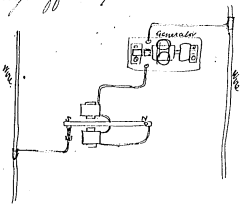
Measuring current by weight of Copper deposited



Edison's Electric Light May 1st 1879 49

Chas Batchelor

Device for cutting machine out when belt slips off or gets otherwise disarranged



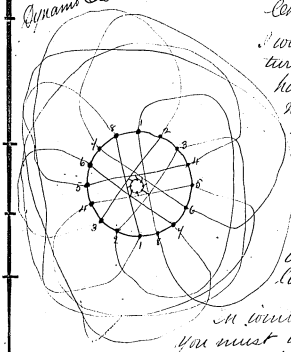
Dynamo Electric Machine

May 2 1879 50

Chas Batchelor

I wound an armature in this way having an even number of commutators and I think this must be the ~~Machine~~ ~~I~~ way Siemens winds his armature?

Lately



In winding this you must wind every other coil and go round twice or else it will not come out right.

Works very well.

8 Coils
8 Commutators.

Batteries

May 18th 1849

Made a cell of 15 couples in the following manner: each cell consisted of first a plate of carbon then a layer of powdered sal ammonia then 2 sheets of blotting paper saturated in solution of sal ammoniac and then a sheet of zinc —

Between each cell the carbon and zinc was fastened together by 2 screws and then the two were soldered together to exclude the air the top of cell was made of wood boiled in paraffine and cemented on by marine glue perfectly air-tight. The record of the battery is as follows.

Batteries May 18 1849

Another 13 cell battery made in same manner except that there were in place of prus. Sal. Amm. a mixture of 3 parts of Black Ox of Mn and 1 part of Carbon This gave the following

May 1st 1879

Edison's Telephone

New receiver.

The remarkable effects produced by the chalk splinter in the receiver and the extreme loudness and clearness of articulation have led me to try a great number of experiments on it. At a distance from the transmitter of 100 feet, everything can be heard perfectly on the receiver in an ordinary lecture room. If different people are talking and some playing musical instruments or whistling at the transmitter and each one comes out clear and distinct. With the carbon transmitter adjusted lightly on the bottom the sounds of a small musical box can be reproduced with 3 times the loudness by simply placing it on the table where the transmitter stands. In ordinary talking such is the amplitude of the chalk of the receiver that its record on the phonograph is a simple matter and the retransmission over the telephonic circuit by the phonograph receiving it again on another phonograph have frequently been done by me; the reproduction of the records on the phonograph being almost as loud as the original talking and the articulation exceedingly clear

Chas F Batchelor.

May 18th 1899 54

Platinum.

The peculiar change of platinum at high temperatures may be due to the Pt. taking up enormous quantities of H and giving it up again at such temperatures

May 19 1879

Electromotograph.

The best theory of the Motograph that we can give to account for the action is this:- That the passage of the current has such an effect on its capillary power as to draw the solution to surface and lubricate it.

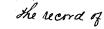
If a chalk cylinder after talking good is left to dry and then put on again, it is exceedingly low and only talks good after turning off. I think this is due to the fact that the Na O crystallizes on the surface and these crystals must be turned off or dissolved out, in order to get good talking.

If a chalk cylinder x is connected to a mirror galvanometer, and the other end of galv. connected to a platinum point xx, and if the point be touched to surface of x no deflection will be observed, but if the point be rubbed along the surface of chalk a strong deflection will be noticed

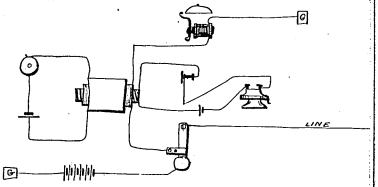
We find it much better to work the Helios for receiving in a tertiary circuit in telephone as its polarization is always constant and independent of the other end.

May 25th 1879

Batteries

Made a battery of 16 couples of carbon and zinc with two sheets blotting paper between and a layer of Sulphate Mercury $\frac{1}{32}$ thick on carbon. The top couple has a  brass rod attached to zinc which has a spring to keep it down.

The record of this battery is as follows



The receiver is this is in a tertiary circuit. We have accidentally found out that the spring we used (which was much better than any other) was made of Paladium instead of Platina and taking into consideration the fact that Palladium occludes 400 times its own bulk of Hydrogen and the autograph shows itself at the pole where Hydrogen is, we think it is nothing more than a battery action.

Edisons telephone. June 25th 1879 58.

The spring on telephone is much better service when dampened by a body of soft rubber as that prevents vibrations of the other parts.

We also find that the chalk when wet with Caustic Soda & water will, after a time become hard on the outside surface owing to the fact that the Caustic Soda and water comes to the surface to the surface by the evaporation of the water on the surface and as the water evaporates leaves the hard scale of Caustic Soda on the surface. We tested this by taking 2 chalks and cutting equal pieces out thus:—

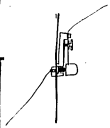
One chalk was new, and just pressed, and the other was old and had been used a fortnight & it had a scale all round it very hard;

In the first one the pieces A & B showed plenty of Caustic Soda in both, but in the other large quantities was found in A & not a trace in B, showing that the amount originally put in, had come to the surface.

Edison's Telephone — July 8th 1879 59.

We find that 2 oz Chalk and ¼ fluid oz of Phosphate Soda makes a far superior chalk in every way; it needs very little wetting, it glazes beautifully, it wears very little, and talks louder.

We find our old inertia telephone works excellently on this receiver so think it possible we might bring it into use.



We make it so:—
It works elegantly even when you hold it in your fingers.
One great thing about this is that it never gets out of adjustment. You can talk right into the diaphragm, and then 6 inches away and it is always all right at that distance although to talk right into it vibrates the diaphragm so powerfully that you cannot tell what is said. Edwd W Johnson

July 25th 1879 —

We find that very hard carbon such as is used in Jablochoff candles is best for transmitting, giving clear talking whether you talk into the mouthpiece or far away.

Syn Insulation

Acetate of Lime will not coat a wire after 30 dippings but the surface of it is slightly roughened as if the Lime reduced and combined.

Acetate of Cerium will not coat in candle flame, but only leaves traces of brown oxide –

Acetate Calcium coats easily at low heat but is very easily rubbed off and when bent it peels off in shreds.

Nitrate of Calcium will not coat at all and does not affect the wire.

Nitrate of Cadmium. It is difficult to get the brown oxide on and when on a red heat takes it all off again.

Nitrate of Magnesia. quite trouble to put on and affects the platina as much as the Acetate.

Aug 1st 1879

Acetate of Lanthanum, coats very well indeed, better even than Magnesia. It does not affect the wire and wire bend very short. It is very hard to get off. I wound a piece of ·004

wire which was coated with Zirconia, and made all the spirals touch, I then put on it 9 cells of Conduit Gas Hanson battery. It gave a good white light and on examining it under the microscope it seemed to have lost nothing but the covering was slightly browned. The acetate must be evaporated down to a syrupy solution.

Aug 10th 1879

Coating Wires for Lamps.

I took 32 inches of ·004 20% Platinum Iridium wire and brought it up in vacuo taking 20 minutes, then covered it with ·001 Zirconia; after commencing to coat this wire broke in my hands and the two ends of wire under the microscope showed a crystalline structure as if one half of section were blackish grey crystals. This happened a number of times and it looks to me as if there were places where the iridium was not properly alloyed but Edison thinks it is due to some chemical

change produced during the process I put it through. It seemed as strange to break without pressure or strain that we began to investigate it and found that a '004 20% wire would stand a strain of 2½ lbs before breaking and if it broke it would always show a well drawn out (center punch) or (chisel) point stretched down till it finally broke so:- these breaks were not at all like the ones made in my hands which makes me still think that if we tried long enough we should have found bad places.

A single layer of wire on a lime cylinder gives a splendid light and never crosses in the spirals, but if heated too much the leading wires would go first. Now if we make a spiral of two layers there seems to be something that crosses the two layers about half way up before it has got much above a dull red and as it becomes hotter

crosses still further down till it gets to the bottom. Whatever its that crosses, on close inspection, seems to move around between the layers as if it was a liquid conductor; It really seems as if the coating of Zirconia stuck at such a heat was a conductor of electricity, and this shows plainer on the 2 layers because there points between the two layers of considerable tension. It may be however that its due to impurities in the Zirconia such as Silica and alos from the Lime bottle

Tried to coat the wire with light coating of Zirconia (Acetate) and then put on coating of Magnesia (Acetate); after bringing up the spiral and examining it under the Micro. I found that the Zirconia was on in a dense mass whilst the Magnesia had taken to itself wings.

The best way I find to crax the wire is to evaporate the Acetate of Zirconia down till it shows a slight milkiness with some white sediment, rub this between your fingers

till it feels slightly sticky and apply to the wire by rubbing same through your fingers till they become almost dry. Pass it then through the candle flame so that it does not get too hot. I am always careful that the wire is never so wet that the heat of candle makes it spurt.
Equal portions of Acetate of Zirconia and Acetate of Magnesia make a good coating which looks very fine after being under the action of great heat.

Aug 12 1849

Titanium Oxide, Stannic Oxide, Aluminium Oxide, Zirconia, Silica Thoria, Chromic Oxide, Tungsten Hydrate all coat from gelatinous oxide and therefore will fuse down to a vitreous mass.

Liquid Stannic Acetate:— It only coats the wire when exceedingly syrupy on the fingers. Passes whilst putting it on, and gelatinizes

on the wire, forming beautiful amethyst globules. It does not attack the wire.

Chloride Zirconia:— This is very difficult to get on the wire and only goes on very rough. It slightly attacks the metal.

Zirconia Hydrate:— Coated a wire with this, which is pure gelatinous Zirconia in water. Could only get on a very thin coating but a spiral made of it stood very intense heat without crossing.

Conductivity of Zirconia:—

I covered two wires today with Acetate of Zirconia and twisted them together very tightly, but so that there was no connection with each other, one end of each I fastened to an end of a battery of 14 large Bunsen Cells, when a spirit lamp was applied to

heat the two wires, they would connect well each other at a little above a red heat: the point where it would make connection always looked (under the microscope) as if some impurity in the covering had been present and attacked the platinum changing it in some way. The platina does not show globules at these points as it generally does when it melts or runs together, but seemed to show a crystalline fracture. A couple of wires wound together that were coated with Alumina did not cross under the same conditions nor yet when heated far higher with the blowpipe. I now took 6 pairs of wires coated with Lucinia that was made especially pure and they all acted alike consequently we came to the conclusion that the covering must be a conductor at that temperature

Aug 14 1879.

Coating Wires

I coated a wire 32 inch long with Chloride of Aluminum .003 thick and wound it in two layers on a spool of lime. This coating broke badly in winding but for all that it was brought up to a brilliant white heat (though not to perfect incandescence) before it melted at bottom of spool. Under the microscope it did not seem to have been caused by the 'tension' between the two layers, but to have melted the first 3 turns on bottom layer and broke connection. Now the only difficulty to overcome it to find some substance that will stand like Alumina and will coat like Lucania

---

I took some Quartz (Si) and powdered very fine + coated a wire by mixing it with water. A spool of 2 layers came up very good showing perfect insulation and under the microscope showed the coating melted down to glass like coating.

Aug 18th 1879

Coating Wires:—

In 'bringing up' the small lime spools with 2 layers of '004 wire on we always find it hottest in the middle owing to the conduction of heat away by the lime bobbin: I therefore took one and lightened it & and the heat was at once made more uniform.—

Took powdered corundum (Al.) for coating: and coats good. The finer it is ground the better it seems to coat; It however requires a high heat to fasten it on. If we could coat the wire without heating it to redness it would be better for the wire. For this purpose I tried a little dextrin & tragacanth in the solution but without effect.

Pressing Oxides for Specs. Aug 22. 1879

Powdered Quartz (SiO_2) and finely divided it by water but could not press it hard. I find that we are not getting the full pressure we seem to do; that when a number of discs are in that do not stand straight a great deal of pressure must be lost by friction on the sides therefore I made another mould to finish them in that had two heads; and the button was put in this $\frac{3}{4}$ and was pressed to $\frac{5}{8}$ In this the enormous pressure comes direct on the material and is not transmitted through a number of steel buttons with possibly unlike surfaces. The first mould is now made with top and bottom shank $\frac{1}{4}$ long and each intermediate button is $\frac{3}{16}$ so that there is always a little to guide shank.

Sep 4 1849

Oxy-Hydrogen Experiments

Zirconia cylinder pressed will not fuse down in large or small piece—

Alumina. pure melts readily in O.H. as also after repeated pressings, powderings etc.

Topaz (Al) yellow glassy crystal fuse immediately and the part not directly in flame but heated turned colorless after standing some time it went viset

Lime pure. not affected by O H flame when pressed in button and treated it tends to spread out but after a second powdering and pressing it is not affected as much

Sept 4th 1879 [71]

Zirconia & Alumina

A wire coated with Zirconia vitrifies at the melting point of Platinum & a hard glassy mass — The same coated with Alumina under same heat vitrifies very slightly — Zirconia cannot be melted by the Oxy-Hydrogen flame but Alumina can very easily — Now the difference between these two heats are this:— when on the wire they are heated by pure energy, but when heated in the Oxy-Hydrogen flame they at the same time are subjected to a flame in which powerful chemical reactions are taking place — As to the infusibility therefore of Zirconia we can say little as with much less heat where no chemical action is present it has fused

— Sept 7th 1849 —

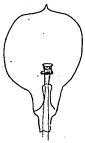
Oxide of Glucinum or Beryll pressed into a hard cylinder turns just like ivory but under the Oxy-Hydrogen decrepitates like Zinc oxide and deposits on surrounding objects —

Lime 80 Beryll 20 makes a white hard cylinder, turns easy, and fuses very slightly in Oxy Hydrogen flame taking a light green color. —

Magnesia fused from the nitrate makes cylinders which easily breaks they hold together very bad

Lime cylinders pressed up very hard when turned have a tendency to break off sharp fracture looking like stone china — this is bad for turning spots of.

Sept 9th 1879



Tried putting coating on wet and winding then gradually drying

42598 / 109051 90 / 256

851146
238569
2129990
2559690
2555588

144
256
1044
870
348
68 / 44544
742

65
4
260

208

.65
10
1000
65
65000

4
16
64
256
384
128
16.64

32
65
160
192
2080

32
32
64
96
1024
32
2048
3072
32768
208

6500 / 68157.44 10.5
61500
3157.0
3250

800 / 2621144
6553.6
48000 / 68157.44

32
32
64
96
10.24
32
2048
3072
32768
208

32
65
160
192
2080

2621144
6553.6
68157.44

Feb 10 1884 Paris

Lamp life varies inversely as the 3.65 power of the candle power –

16 candle lamp at 64 candles lasted 174 minutes

Life at 16 candles : life at 64 :: $64^{3.65} : 16^{3.65}$

$$x = 174 \times \frac{64^{3.65}}{16^{3.65}} = .$$

$$\frac{64^{3.65}}{16^{3.65}} = \frac{109051.90}{42598} \cdot 256$$

$$x = 174 \times 256 = 44544.$$

$$44544 \div 60 = \underline{742} \text{ hours.}$$

By the Table of life we have, if we suppose that the lamp gives 800 Volts at 100 Volts and depreciates for every Volt 22% that would give

Volts 100	= 48000 mm	106	= 10809
101	= 37440	107	= 8431
102	= 29203	108	= 6577
103	= 22777	109	= 5130
104	= 17766	110	= 4001
105	= 13858	111	= 3121

111 =	3121	119 =	427
112 =	2434	120 =	333
113 =	1899	121 =	260
114 =	1481	122 =	203
115 =	1155	123 =	158, minutes
116 =	901	124	
117 =	703		
118 =	548		

Essay 28 Jan 1884

10 candles at 40 candles

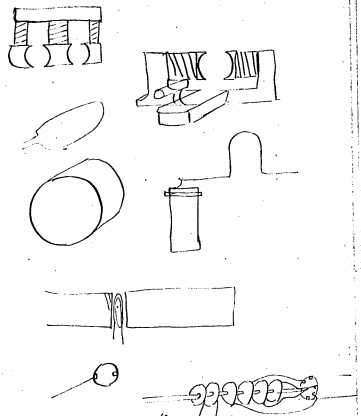
Average 170 minutes

What is life at 10 candles.

$$x = 170 \text{ min} \times \frac{40^{3.65}}{10^{3.65}} =$$

New York. Oct 11 1885 [795]

Dynamo.



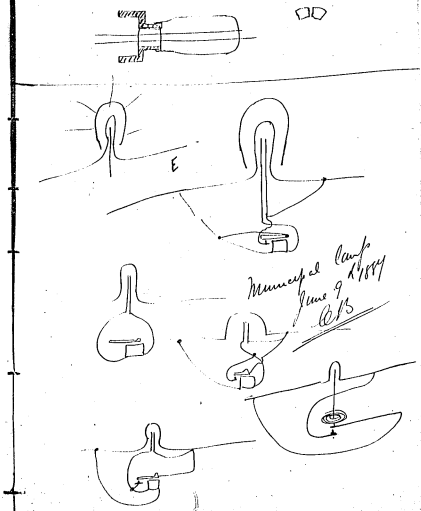
$$\frac{600 \times 1.30}{60}$$

$$32.4 \times 3 = 97.2$$

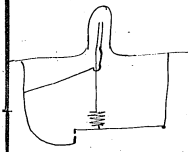
$$\frac{1700 \times 1.44}{60}$$

$$24 \times 1 =$$

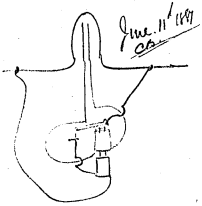
$$2.4$$


E
Municipal Camp
1/1884
June 9
C.P.B.

Minerp & Carp June 9/1891.
CD.



June. 11/1891
CD.



1 T A E. myself at Washington Apl 18
2 Myself taken by E Light at Menlo Park
3 E & his assistants Stop of Lab
4 " " " inside Lab
5 " " " stops (smaller)
6 View from Lab. at M Park
7 Hashhouse.
8 Stop of Gillelands House Florida
9 Edisons F & property
10 E M W N.Y.
11 City Berlin 1881.

[78]

Tilly Foster Concentrate

Total Weight grains

2 D 1 sc. 2 1 gr. = 142½ ~~[illegible]~~
3 Drams 2½ grs. = 142½ ~~[illegible]~~

Concent. 1 Dr. 2 Sc. 73.33 4½ grs = 104⅓
Iron Mag. 54% 1½ Sc. 26% 7 grs 37½
Gross.

Tilly Foster Tailings.

	Total Weight	Dr.	Sc.	Gr.
	223½ =	3.	2	3½
Mag.	37	16½%	1	17
Iron Mag.	182½	81½	3	0	2½

Three packs of m RR Cut Away Set

	Dr	Sc	Gr.
Tilly Foster Total Wt	2 =	1 -	0
Magnetic			
Iron Mag.			

FeO 28 112
16 32
144

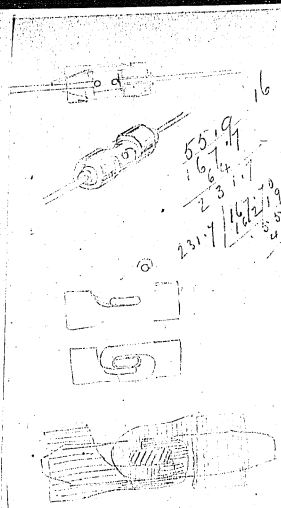
144/1120 | 1.7
1008
1120

Fe_3O_4 28 84
8 32
116 / 840 | 0.72
812
280
232

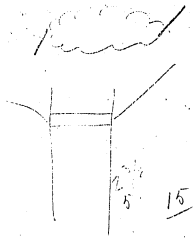
3198

Lead 206.4
3198
238.38 =

206.4 : 238.38 : 86.58
789704
119760
143028
190704
206.4 / 206398 ~~9.972~~
1061



1 = 10.267



2.4 20
4.800

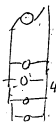
5 15

Mag. 11

Now Mag $\frac{29}{40}$ | 110 | 0.275 × .72
50
300
280
20
0550
01925
19800

110 2.3

50



110
2.3 | 1100 | 48
184

48 = $\frac{19}{23}$ =
24
1 22 - 32 c

24 tin & rod $2.0k

15 × 24 × ~~1.8~~ 3.2
24
60
30
360
32
720
1080
12 | 1152
96.0 feet

Ore samples.

[817]

#1

Thomas Tracey
#1

Dec. 29 1890

From Juneau Alaska

Hard Porphyry.
White rock plentifully sprinkled with iron pyrites crystals

Gifford No gold
of silver

0.15 oz per ton 2000 lb

#2

Thomas Tracey
#2

Dec 29 1890

Mr. Juneau Alaska

Soft rock White talcy.

No gold - 020 oz silver per ton 2000 lb

Magnetic lines on blotting paper Jan 9 1891

□ poles ·021 apart. – 37 minutes

No perceptible effect even when put in water

Magnetism Shellac

A

small piece shellac, if in lump tends to turn the longest section lengthwise with lines if in shape needle like A turns lengthwise strong

B

Square cube of cork does not give any sign of moving. when put in shape of needle it moves towards lengthwise weakly

CORK

Sapphire.
Tends to put its longest axis in the direction of lines of force quite strong

Neither Shellac, cork, or asphyre have the slightest attraction

Wooden match

tends to go lengthwise but no attraction about same as cork.

Fabers lead pencil lead

strongly magnetic.

Glass sphere

perfectly round – no tendency to turn either way

Glass sphere set spinning rapidly no perceptible lessening of speed when magnet on

Glass tube – this seemed to act queer it was a very week action

but decided to set its length across instead of along the lines of force — this seemed to me at first as if it was repelling but when I took one pole away the other would neither attract or repell

I think the above phenomena is explained simply by the fact that the { Shellac, Cork, Saphyre } are nearer to iron in regard to their capacity to conduct lines of force than Glass

Expenses of Laboratory

per month —

Rent	$40 =	$40
1 Man $3 26 days	-	78
1 Handy man	-	40
Gas & Water	-	3
Electricity & Coal	-	25
		$186
		12
		$2232 per year

Transmitter	Motors	Cells	Elec.	Hydraul.	Oil
10 E.H.P.	~~Electric~~ N.O.G.S.	Cells			
50 H.P.					
10 Hydraul. H.P.					
50 Hydraul. H.P.					

Where found –

Cd. is extracted from Zinc blende at Engis Belgium
Watts VI 381

Greenockite is CdS. 77.7% Cd
22.3% + Bishopstown in Renfrewshire Scotland is the only place in the world that the mineral is found in the pure state.

formation of oxides of Cd & Zn – the powder thus deposited is mixed with charcoal & treated in iron tubes when the Cd distills over Roscoe Vol II pt 1 266

properties.

Cd resembles tin in color but is somewhat harder. It is white, malleable, ductile has a density of 8.6, melts below 320°F & is nearly as volatile as Hg. It is a constituent of alloys that fuse at low temp. It is also employed in amalgams.

21 Cd is used to alloy silver because it impairs but not greatly flexibility & ductility without impairing its white color

26. Cd. discovered 1817 by Stromeyer in a sample of Zinc Carb from the Zinc Works at Salzgitter. He observed that it yielded an oxide that although it contained no iron possessed a yellow color Roscoe Vol II p1 265

29 "Cd occurs mixed with Zinc ores, as a sulphide in greenockite a somewhat rare substance from Bishopstown & Kilpatrick in Scotland & Bohemia & Pennsylvania the Cadmium in the various samples of Calamine & Blende vary from a blende at Przibraim Bohemia 2 & 3 %, Calamine of Mesabrok 1.6% & that of Eaton in N.A. 3% Cd.

Roscoe Vol II p1 266

In Zinc smelting the more volatile Cd comes off first & burns in air with

Chem Constr

38. CdS is known a Cadmium Yellow & a great variety of hues are produced by mixing it with white lead Chaum. Enc.
The iodide & Bromide are used in photography

3 Cd
The Sulphide known as Cd yellow is bright in color & is of great ~~use~~ value to Artists

Cadmium
1— Cd is the only metal that forms a yellow sulphide insoluble in side ammonia —— Watts 1-705—

Alloys.

34 Alloys readily with gold or Pt but make them brittle with Cd or Zn
malleable & ductile

30. Alloy of Platinum & Cadmium
Heating Pt with excess of Cd till excess is volatilized — Almost silver white, very brittle, fine grained, refractory in the fire
It contains 46.02 (1 at) Pt & 53.98 (2 at) Cd Gmelin 6 335

13. Cd 2, Pb. 11, St. 3, Bi 16 melts 170°F

10 Cd. in alloys imparts the property of melting at low temperature without brittleness

16. Cd. 1. Bi 4. Pb 2. St 1 } melts at
or " 3 " 15 " 3 " 4 } 150°F.

14 Cd 10 Pb. 8 St 3 Bi 8 " 167F

4 Cd.
15 Cd 1 St 2 Bi 3 } all melt at
" 1 " 3 " 5 } 203 F.
" 1 " 1 " 2 }

22. Cd. imparts to Gold & Silver a beautiful green color.

21 Cd 22½, St 36, Pb. 50 makes a clichè metal which has greater hardness than those of Bi alloys and yet has as low a melting point. A large number of sharp impressions can be taken from it

26 The fusible alloys of Cd & Bi possess the property of melting in an amalgamated state at a still lower temperature than by themselves — By adding a suitable quantity of Hg to them they are well adapted for filling teeth or for cementing metals

5 Some of the important ones are

	1	2	3	4	5	6	7	8
Silver	950	950	900	800	666	667	500	
Copper	15	15	15	20	25	50	50	
Cd	5	35	85	180	309	284	450	

In preparing the above the Ag & Cu must be first alloyed & then the Cd wrapped in paper & thrust in slowly & immediately cool & prevent the Cd volatilizing

9 As regards sharpness are equal to the best Rhodium & Platinum Crucibs & with its silver white color make a neat appearance. Good also for small Statuettes or hollow busts Brandt 1889.

11 Lipowitz alloy Cd 3, Sn 4, Bi 15, Pb 8 coffees at 140°F & melts at 158°F.

It has a silvery white color & aluster like polished silver, it can be bent short, hammered & turned — Used for making small sharp ornaments equal to Galvano plastic products — Plaster of Paris is poured over the animal to be cast & after sharply drying the whole the animal is withdrawn & the metal cast in it by putting it in boiling water.

12 Lipowitz alloy is used for soldering tin lead & Britannia Metal & nickel but it's costly & cheaper alloys are nearly as good

$ Cd metallic is $1 per lb.

17 Wood's alloy
Pb. 4. Sn 2. Bi 5.8. Cd 1.2. In color resembles Pt + is a certain extent malleable + melts ~~at~~ between 140 + 161.5 F.
18 Cd. 1. Pb 6. Bi 7. Like the preceding can be used for soldering in hot water + melts at 179.5 F.
19 Cd 2. Sn 4. Pb 2 melts at 300 F. it makes an excellent soft solder melting about 86° lower than Pb + Sn alone

12 Away by volatilization

37 - Production
1874 Lower Silesia 25 cwt
~~work 7800 per ton~~

Owing to small demand many works give it up Ency Brit.

[992]

32 Production of Cd.
Germany in 1887 7321 tons

36. Only 30.12 % of the Cd contained in the material heated is recovered 20.17 % is left in residue + 48.71 goes

24 When making Lipowitz metal add to the melted alloy 1/4 2 parts which has been heated to 212°F — Like from the fire + after mixt it solidifies — This now melts at 143°F — Very suitable for producing impressions of leaves etc

Cd & Hg alone ~~can~~ make an amalgam solid & malleable & used for dentistry -

23. Cadmium Amalgam Cd 5 Hg 8
Heat the Hg nearly to boiling & then add the Cd in thin sheet -
It remains soft for some time & becomes crystalline only after a considerable time - It forms a tin or silver white mass which softens on being moderately heated & can be kneaded like wax - owing to its ductility it can be used for many other ~~things~~ purposes.

24 An alloy of equal parts of Cd & Hg is extremely plastic & can be stretched under the hammer like pure gold it is silver white & constant in the air.

25. Evans metallic Cement - Cadmium amalgam Cd 25.99 & Hg 74.01 dissolved in excess of Hg & thoroughly kneading in a leather bag especially if the amalgam be previously heated to about 97 F. is rendered very soft & plastic & can be brought into any desired form - On cooling it acquires considerable hardness but not equal to pure Cd amalgam

Ll. Sources. Pa

When found as an alloy of Pd & Au the Pd is separated by fusing the alloy with silver & boiling with HNO_3 which leaves the Au undissolved. The Ag is then ppt. from the solution as chloride by adding Cl. of Sodium and metallic Zn is placed in the liquid which ppts. the Pd, lead & Cu as a black powder. This is dis. in Nitric Acid & the sol mixed with an excess of NH_4OH (Ammonia) which ppts the Oxide of lead leaving the Cu & Pd in solution on adding HCl in excess a yellow ppt of Hydrochlorate of Palladium N_2H_4 Pd 2HCl is obtained which leaves metallic Pd when heated –

Tellurium	Palladium
1 Discovery	1 Discovery

Li. Where found.	Id. Where found

Ir.

Symbol Te
Atomic Wt: 129.
Specific Gr.

Pd.

Characteristics
1 Symbol Pd
2 Atomic Weight 106.5
3 Specific Grav. 11.5
4 Harder than Platinum
5 Malleable } like Pt.
6 Ductile }
7 more fusible than Pt
8 When heated in air it becomes blue from superficial oxidation but good Nequim its whiteness when further heated the oxide being decomposed.
9 At a slightly elevated temperature absorbs mechanically many times its volume of H.

Le Discovered Pa.

Cd.

Dr. Clarke of Cambridge has
discovered the metal Cd in the
radiate Blende of Derbyshire
1820 Black's Mag 6 page. 409

Charles Batchelor Notebook, Cat. 1234

This notebook was used between November 1879 and November 1895. All of the entries are by Charles Batchelor. The name of Martin N. Force appears occasionally as a witness. The material relates primarily to the electric light, the telephone, electric traction, and chemical and metallurgical experiments. There are some entries pertaining to spiritualism and to unusual phenomena. Included also are lists of books read by Batchelor and a list of electric light articles and patents from the 1840s through the 1880s. An index to correspondence, probably dating from the 1890s, can be found at the end of the book. The book contains 109 pages, numbered by an archivist. There is one unnumbered page between pages 86 and 87.

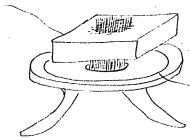
Blank pages not filmed: 51, 103-109.

1.

Experiments and
Notes relating to a
New System of Telephony
Devised by me this
day November 1st 1879

Chas Batchelor
Menlo Park
N.J.

1 Make a transmitter to work on the following principle :-



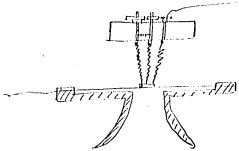
2 pieces of gauze of about 150 mesh one on each side of a piece of metal has its mesh all filled with metal pins which project out of the bottom and rest on a platina surface of a diaphragm - When diaphragm is vibrated it will have greater or less resistance owing to the inertia of the little rods —

Test resistance of transmitter and make coil to suit -

Nov. 1st 1879

Chas Batchelor
Martin A Force

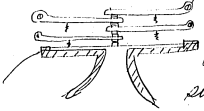
2. Make Transmitter of Platinum springs which open and close by action of diaphragm so :-



Diaphragm vibrating opens and closes the ~~transmitter~~ springs giving more or less resistance — Adjustable springs — Make one to suit

Nov 1st 1879 Chas Batchelor
Martin M Fox

3. Make Transmitter so :-



Variation of contact on purely metallic surfaces sufficient to give good talking — I have frequently got very good talking (that is I mean have got some words very distinct,) with only one point, but

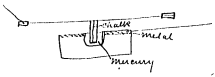
the adjustment is too fine and cannot be kept — with a number of points it can I'm sure

Nov 1st 1849 Chas Batchelor
Martin A Foran

---

4 Receiver —

an idea for a receiver is as follows: —



a diaphragm has on its centre a cylinder of chalk which has a wire through with slate in end, this rests in mercury which connects with ring of metal at top of cup — the current has to pass through the mercury and in so doing the mercury makes a movement this will raise and lower the chalk with sufficient force to vibrate the diaphragm

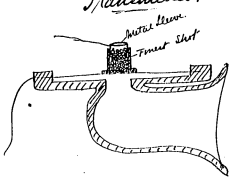
It may be that some other substance may do better than chalk – probably something with a rougher surface

Nov 1st 1879 — Chas Batchelor
Martin M Ford

Nov. 17th 1879

5

Transmitter.

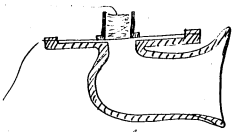


Talk in side – Cup full of fine shot on diaphragm top of cup lined with metal from which the connection is taken off.

Vibration of diaphragm disturbs shot and gives variation of resistance –

Chas Batchelor

6 Transmitter.



Diaphragm vibrates and lifts a number of copper wires laid across each other — these follow the diaphragm down by gravity

Nov 14th 1879

Chas Batchelor.
Martin M Foote

---

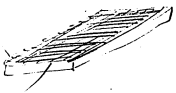
7 Transmitter

Make a transmitter with a ~~button~~ number of discs of fine mesh gauze.

Nov 14th 1879

Chas Batchelor
Martin M Foote

8 Transmitter

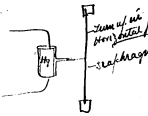


Fine wires stretched across a box both ways and adjusted so that they make slight contact — by talking you will make them touch more or less.

Nov 14th 1879 Chas Batchelor
Martin M Ford

---

9 Receiver

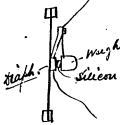


When current passes through a globule mercury it tends to widen out the other way — this motion in a small tube could be connected with a diaphragm for to get talking

Nov 14th 1879 Chas Batchelor
Martin M Ford

10

Transmitter.



Graphitoidal Silicon conducts electricity therefore make an inertia telephone of it as in sketch — Amorphous Silicon won't do as it is non conductor —

Nov 14th 1879

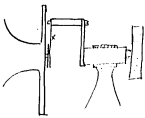
Chas A Bentchelor —
Witness M. Force

10

Telephone. April 4th 1880

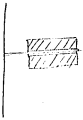
About a year ago I made an experiment where I had a platina plate laying loosely on a platina faced button, and thinking that I had a carbon button between I got good talking by a fine adjustment. Noticing a peculiar metallic ring to the talking I took it apart and found that I had nothing but the two metallic plates touching each other — I then examined it carefully to see if there was any dirt between the plates but could find none — Martin Force was trying this experiment with me — The time we tried this was about April 1879 I know it because it was between the time C P Edison went away

and E. H. Johnson going to England
now make a transmitter this way:-



x Adjustable platina foil against disc or diaphragm.
also cut foil in strips

Chas Batchelor.



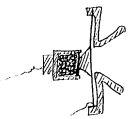
Transmitter for telephones

Oct. 4th 1880

Chas Batchelor

Telephone receiver

In Aug 1877 (20th). I made an instrument for a transmitter from T.A.E.'s design in which we used silk pieces coated by graphite.

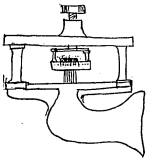


Whilst experimenting with this instrument I discovered that we could use this instrument as a receiver and we did so Adams and myself talked with it at the time perfectly. T.A.E. was present and knows that we got what was said although I think it was too low for him to hear — Since that time I showed it Mr Butler — previous to Prescott's book being written (his edition of 1879)

Oct. 4th 1880

Chas Batchelor

Telephone

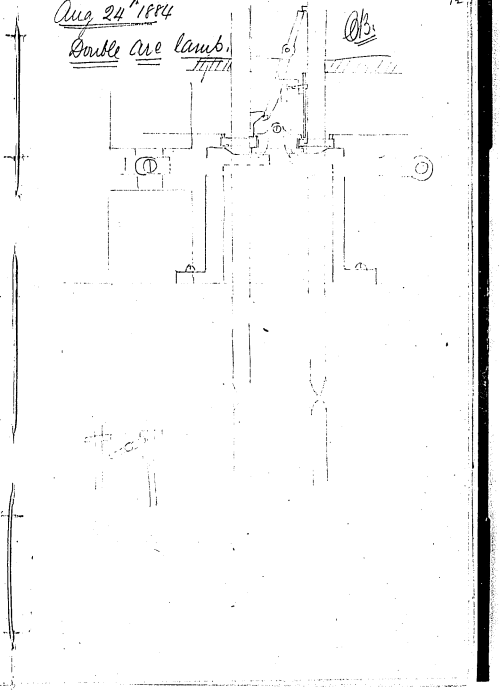


Make a transmitter with wires in shape of a long legged U so:- ∩ and put about 50 of these so that the long end rests on the diaphragm and the short end rest in a cup of mercury which is adjustable.

Chas Batchelor
Apl. 16th 1880

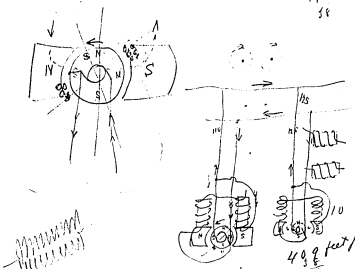
Aug 24th 1884

Double arc lamb.



Oct 14 1886.

19 ohm
58



49 feet per ohm

66
200
75 2 01
1.598

11.5 mean dia
46
46.0
115
505
161.10

36 / 1 5 5 / 1 2 9 5 / 4 9 2 turn

3 / 1.5 5 4 / 5 1 8 1 ampere

12
108
12
11½ average dia

+ 38 / 4 / 42 / 1 2 8 | 3 amperes passing

·75 / 1 2 8 0 / 2 0 6 lamps
9 5 6
9 5 6
1 = 66 / 1 4 0 0 / 0.52 ohm.
7
2 3 3 0
2 3 3
7 6

5 1 6 1
15.5 5 3 amperes shunting magnet
6600 in armature.

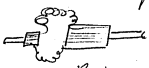
Oct 17th 1886.

Commutators.

Commutator of a block of soapstone & cut out with cutter – Let the bars in & bind down with wire on mica –

Another way would be to make a mould & screw all the bars together in & afterwards mould up with plaster & bind down & turn off.

Edison's non sparker Nov 4th 1886 15



#4 armature
50 blocks
Resist ·044 ohms

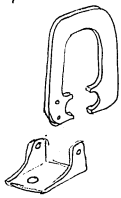
Resist of each loop ·0035

Brush made to touch three bars —
If only one loop was short circuited then
·0035 + ·044 or the current would discharge
in 13 times greater

Now is the counter of our discontent

Nov. 6th 1886.

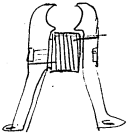
Experiment —

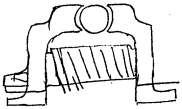


Cast 4 plates like this $\frac{1}{4}''$ and mount them on an armature — Wind wire around each leg & take readings from the armature — Then dismount and send the plates to an annealing furnace to be made malleable after which put on and try again

OD

N
N
S
S





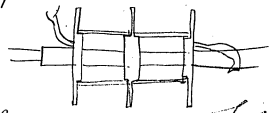
Nov 25th 1885

1 Does the armature have an attraction on the wire when there is a heavy load on armature?-

2. Why does an armature run in same direction as a motor when speed and not reject light on two in multiplex?

9. A dynamo running slowly with no field & no brushes on — When brushes on the field is on. Brushes short circuits & set on, the armature stops & rescue — Why?

Experiment Nov 20 1886



Make armature hollow & put in pipes for air -

Standard of M. =
that number of lines of force
that will give 1 volt in 1 ~~foot~~
wire in one second
What standard have we on our
machines

On a L. effective length 11"
Outside Dia. 10"
Inside " 9.687"

80% effective field

Diameter 74
Res. .038 ohm
1200 Rev.
1 wire 2 turn wound

Speed of cutting = 19.687" ÷ 2 × 3.14 × ~~1200~~ 20/60
~~60~~ 9.84 × 3.14 × 20/12 = 5.146' per second

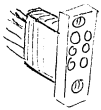
L. = 22" × (74 × 80%) × 2 = 44 × 59.2 = 2604.8 or 217° per
~~217°~~ × 5.146 ~~× 110~~ V/M
110

0.625
11
6.875

74 | 16.8 | 0.21
74
72.0
74'12

80%
5.146
59.2
44
2604.8
5.146
97.864

New connections Dec. 13th 1886



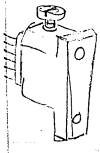
1 Wires brought through and rivetted – no solder

2

Wires from the coil lapped together + only half the number of wires led into the cup. no solder

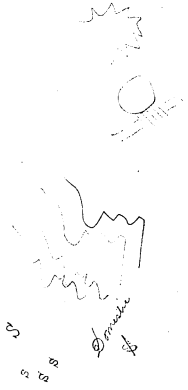
3

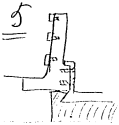
Still not pure copper and slip it on the wires – Cup to be made as a clamp 20/– No solder



4 Wire for cup bent 50/–

the ends are bent up to the shape of the armature wires thus round to make good contact



5 

Wire turned up to get a long contact on the cup

6 Fuse the wires together with the 'arc' – If the oxyclesis too much then use quantity current + fuse where bad contact is made.

7

Make a hardened steel dimmy and hammer the wires well together in it to give it shape 1 & 2 – this will require least solder

Feb 5 1887

Aluminium Electroplating —

Richards says it succeeds only by a molten bath of anhydrous Al^2Cl^6. 2 NaCl melting at 165°C (329F) but metal is a powder mixed with NaCl.

Gore says:- he has coated with Al from Al^2Cl^6 of a weak current —

Jan 1888.

Experiments to be tried

1 Take a small piece steel and heat it by electricity in a strong magnetic field –

a. Plunge it in water whilst still in the influence of the lines of force

b. Let it cool off and note any difference in grain, hardness, tensile strength etc.

---

2. Take the different wrought irons and see if

a. heating & plunging in water in the field makes any difference

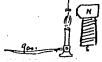
b. The same operation repeated many times

c Try same operation with Cast iron

---

3 Iron loses its magnetism at a red heat. There may be some metals that become magnetic at a temperature between ordinary and a red heat. Try all metals – If we heat them by current the magnet would attract the wire due to the current in it

Try this without current by using very small pieces & placing them suspended in a bunsen flame and regulate gas for different heats.



Magnetism Jan 1888.

4 When Edison dynamo is running its resistance of magnet increases by heat — It may be that the magnetism is also reduced by this heat in proportion as it is heated

---

New Compound

5 One atom Sulphate Barium fused with one atom Chloride Barium makes a white translucent mass. With 2 atoms Sulphate it resembles marble. Perhaps this could be done + mixed with a large quantity of fine white sea sand + make a cheap new material

---

6. Alloys

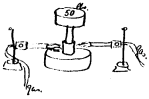
Cobalt + Antimony Gmelin Vol 5 359
Cobalt + Zinc

1 part Cobalt powder
2 " pulv. Antimony } heated together unite with incandescence + form an iron grey mass which acquires metallic lustre by pressure

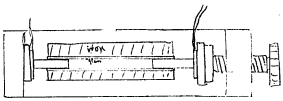
1 Cobalt powder
2 Zinc } heated, emit red light — + make grey spongy compound which takes lustre by pressure

over.

Make an apparatus to put pressure on these during the heating operation & see what effect it would have on the alloy—



Also heat them in closed iron tube which are entirely full of the mixture & see what effect it would have.



7 New Compound Feb 1888.

Mix Plaster Paris with Alum water and see if it hardens it like marble

8 Hardening Metals :-

Common steel Heat + plunge in Common Salt

9 Common Steel - Heat + plunge in

	Cor	Ano	Chromium	
10		33	56	79	~~Bichromate of Potash~~
11		34	57	80	Cyanide of Potash
12		35	58	81	Hydrofluoric Acid
13		36	59	82	Chloride Ammonium
14		37	60	83	Acetic acid
15		38	61	84	Citric acid
16		39	62	85	Bromic "
17		40	63	86	Carbolic "
18		41	64	87	Gallic "
19		42	65	88	~~Hydrochloric acid~~
20		43	66	89	Hydrocyanic "
21		44	67	90	Lactic acid
22		45	68	91	Malic "
23		46	69	92	Nitric "
24		47	70	93	Nitro muriatic acid
25		48	71	94	Oxalic acid
26		49	72	95	Phosphoric acid
27		50	73	96	Succinic acid
28		51	74	97	Tannic acid

Feb 1865.

	Cantan	Copper	Wrain	
29	52	75	98	Tartaric acid
30	53	76	99	Uric acid
31	54	77	100	Vanadic acid
32	55	78	101	Fluoritic acid

102. Alloys. Wax dc. VIII 1264

Aluminium & Manganese alloy Mn^3Al
Scratches glass — fracture like amalgamated
Zinc — try it for cutting tools

103 to 126

Take nickel wire and heat and
plunge into same substances as
Exp. No. 101

124. Iron in Nitric Acid — Phil Mag. Jan. 3. Feb. 53
Schonbein & Faraday's experiments
try them & see if anything can be
made out of it

125. Magnetism —
Get flat bottles & put between the
poles of a magnet with different
substances in each & see what
action it has on them —

29. Feb 1888.

129 Voltmeter

Seubel proposed a voltmeter made of a spool of solenoid with an iron spiral in it — Traction pulls in the spiral & this works a scale.

Try it this way.

A spiral fastened by the middle to a brass rod A with a hole through it — then put in the solenoid and fastened — both ends are drawn in by solenoid and the resultant of both movements is shown at B

130. Action of Steam Pressure on

131 Bamboo -

132 Hard rubber.

133 Horn

134 Ivory

135 Vegetable ivory

136 Slate

137 Take an Edison Dynamo and set on full load & take volts — Throw off loads (always leaving on the short load (amps) varying from full to 0 load & every variation & take volts &c

See if the variation of volts is not out of all proportion to the theoretical drop in the armature —

138. Action of Steam at 80°. March 3 1888.
on
Cork.

139 Data on Soft rubber.

140 Artificial Caoutchouc
Mix some Linseed oil 100
Chloride Sulphur 20.
Make some & investigate

141 New Compound.
Linseed Oil 1 part
Comm. Nitric Acid 2 parts in 4 times its bulk of water make a tough elastic resin —
Perhaps this can be mixed with sawdust & pressed & make wooden ornaments

March 4 1888

142. Try same with thin solution of Glue

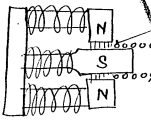
143 Try 141 with Kaolin & Pressure

144 Red Coloring matter –
Make some Brazilein – Watts dic. Vol VIII pg 348. – See whether it can or is being used.

145 Electric Meter. Aluminium
A voltmeter of Pt + Al. only lets the current pass when the H is evolved at the Al pole – perhaps this would make an alternating current meter if it is quick enough. – Try it.

146. Try a voltmeter of Pt + Al & blow air in to see if it acts the same or whether it is oxide on the plate

147. Magnetism



a Solenoid with a strong current in it – When current is put on will the magnet pull the Solenoid forward to centre of line of force – If so a powerfull reciprocating motion can be made

See Page 34

148. Magnetism

Find a magnet this shape – See where the poles are then slip X through so that it sticks out at other end – See if it has opposite pole

149. Magnetism

Make magnet like this and see how strong it can be made

March 10 1888

150 Dynamo.

Difference in quality of Iron for magnetism

Take a small dynamo & try for magnets

first

~~Wro~~ Cast iron magnets as against wrought iron but square section against circular

then

Make a series of cast iron plates ¼ thick like sketch of same section as above & same winding

Then take them apart & anneal them & make them malleable & try them again

---

151 Magnetism

~~Put a current through a piece of iron spiral and see if the spiral is magnetic & with what current.~~ See 1873 C.S.

---

152. Magnetism Walk VIII 1250

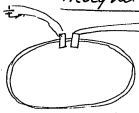
Steam at 5 or 6 at. passed through a copper tube of 2 or 3 mm thick coiled round an iron cylinder the

iron becomes magnetic remains as long as it is in — Lommai Amplt Kender 80–100 Mauvenné says it is thermo-electric current that magnetizes. — Read the article & see if he proves it a thermo current — If not make the experiment & enclose the whole in a steam jacket & keep same temperature & see if the current is still there

— Steam jacket to keep all at same temperature

---

153 Magnetic induction March 12 1888



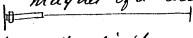
Take two telephones spools and a heavy iron wire (straight & hooked) and see what effect distance has on the other when a battery current is put on one that will saturate the iron that it covers if it was cut off.

---

154. Induction in Telephones

It occurs to me that noises by induction from other lines in telephones are essentially very much weaker than the noises

made by the generation of current on the line by talking that some method ought to be devised to reduce the former to zero whilst not very materially reducing the latter — Attach a long wire to the magnet of a receiver and carry it



a suitable distance to another diaphragm — Perhaps the weak induction sounds will not transmit longitudinally in the wire so well as those directly generated in the wire

---

155 May ~~Stet~~ 12 1888

Life of Lamps.

Take an ordinary Edison Lamp and coat it ½" thick with plaster of paris. Take life —

---

156 Lamp life May 1888

Enclose a lamp in a casing of pure Plaster of Paris & see if the effect is to shorten the life

June 1st 1888.

157. Antifriction metal

See if glass can be mixed in any quantity with lead & poured for a bearing —

June — 1888.

158. Aluminium — Absorption of a compound of Iodine from Iodic acid by immersion — Nature Vol 29 p 254 A sheet of Al. immersed in 17.5 gr. pure Iodic acid + 3½ g distilled water absorbs 16 per cent of foreign substance & changes somewhat its nature —

---

159 Telephone — Phil Trans 540 f. Vol 23 Series 5. Fae says that Antimony and Cobalt alter their resistance when brought into the Mag. field — Investigate this and see whether it can be arranged to get enough for working a telephone in some way

Sept 14 1888.

160 Torsion - See if ~~a current of Electricity~~ Magnetism is generated by a bar of iron under heavy torsion also under tensile strain

---

161 Lamp extinguisher Nov 12 1889.

a good patent would be a lamp ext. for Kerosene lamps - It must automatically ext. whether the lamp is broken or only knocked over -

---

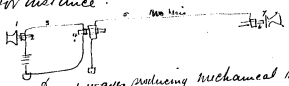
162. A simple method of getting Dec 1889. fresh water from Sea water so that ships do not have to carry so much but can always get it.

---

163. Moulds for casting brass or iron that can be used over & over again

164 Telephone. Dec. 1890.

In telephoning the loudness of the received message is many times lower than the talking at the other end — This is undoubtedly due in a great measure to the different transformations of the energy so for instance:



1 Sound waves producing mechanical vibration
2 Variation of magnetism
3 Induced Electricity
4 Magnetism
5 Induced Electricity
6 Magnetism
7 Mechanical motion of diaphragm

So if we started with an initial 100 that only 10% in each transformation

1–2 = 90 " 2–3 = 81, 3–4 729 " 4–5 65.61 —
5–6 = 59.05 " 6–7 53.15 % of original —

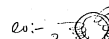
Now in the secondary circuit ≈ 5 the resis of the coil is generally 250 ohm & resis of receiver about 50 so. only $\frac{1}{4}$ of the energy is at receiver

$53.15\% \times \frac{1}{4} = \underline{13.79\%}$ of total

or taking 59.05 at 5–$\frac{1}{4}$ gives these = 14.76, 10% loss from 6–7

13.28 of total

This might be made better by making first: a

using induction coil as:-  S & then by making receiver equal resistance to the induction coil so as to get $\frac{1}{2}$ instead of $\frac{1}{4}$ of the energy.

suppose E.M.F in Sec. was 100 then in first case.

$\frac{100}{150+50} = .5$ Amp. $= \frac{50}{100}$ Va. $= 12.5$ Va on receiver

$\frac{100}{150+150} = .33$ Amp $= 33$ Va $= 16.5$ Va on rec.

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165. A Shark during the freezing of water by Oliver Phil Trans. Vol 4 Series 3 p. 156 Try this & see if can find out what it is caused by Dec 1890

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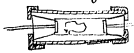
166. Instrument for observing decomposition by high voltage —



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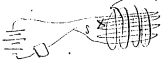
167. Measure the resistance of iron core coils up to at X & then mag.  N reduce it by Z current & see if any difference in resistance Dec 1890 —

May 1891

168. Cut a section of Lebanon wood with razor and mount for Microscope

169 Grind slate & 100 meal + see if it can be moulded with cement about
95 Slate + 5 cement

Feb 16 1893

170 Get bars ¼ □ + 3" long of

7 Antimony + 3 of iron —
1 Antimony + 1 lead.
1 " + 4 "
1 " + 2 nickel
1 " 9 tin
6 " 43 Zinc
6 " 33 "
1 " 1 Bismuth

Offer

July 1 1893

171 Collect some hundreds of lightning cases & see what deductions it is possible to make from them ——

July 13 1893

172. Collect the compositions that have been published of #

Different woods
" leaves of trees & seaweeds
" ashes of woods " "
" " " leaves
" fruits
" Kernels and shells of fruits

Fire escape Sept 1893

173 It seems is easy to make an apparatus that will lower loads at a uniform speed that it seems to me such a one ought to be applied to fire escapes — It should automatically lower whenever one person gets on & should go as quicker if more are on —

174 Sec. 151 Dec. 11. 1893.

Iron spiral with current sent through it is magnetic

175 Expansion Engine Dec 11 1893

Metals expand between 1° + 100° C from .0009 Flat. to .0029 Cast Lead — With 2 in gas pipe + 20 feet long you would have a movement of about 3/8" with a number or 2 you can get with leverage about 1½" movement — It is however too slow. I took a hard rubber tube 30" long + measured it — then put water in it about 100° + it lengthened 1/16" but it took over a minute after I threw the water out + blew in it before I came back — This was about .0021 or about same as Cast Aluminum

176 Mineral Agaric (Agaricus Mineralis Watts 1 62.) — it kind of fossil meal — is really hydrated Silicate of Magnesia with lime + Alumina (Query how much) + a small quantity of iron — this might be good for making furnace linings — Found in Germany, look it up + see what it is used for.

147. Album Græcum (Watts 1 64) this is dog manure & it contains 79 per cent of phosphate of calcium – I have seen this being collected but I did not know what for –

Dec 1893.

148 Tellurium in quantity, Dec 1893

Mineral called Ammiolite a red earthy mass found in Chili contains: –

36·5	Antimony
14·8	Tellurium
12·2	Copper
22·2	Mercury
2·5	Quartz.

Query: How much to know of this? Besides Oxygen c

149. Chlorodracmyl. – A thick oil 42·6% Carbon 3·4% H. made by heating Oil of Tansagon with Alcoholic Potash – Watts 1 p. 299 get some to see what it is.

Dec 1893.

150. Opium – Sticky yellow Make some – Watts Vol 1 300.

Dec 1893.

151 Asafetida Resin of Asafetida –

70·2	Carbon
7·6	H.
22·2	O.
100·0	

Dec 1893

extracted by Alcohol. Watts 1 p. 414.

182. Table of Ash Compositions See 1893
Liebig & Kopp's Jahresbericht – für Chemie 1847-52
Ure's Dictionary (New) p 212

---

183. Bitumen (Asphalt)
Asphalt at 250° gives off Petroleum & residue is Asphaltene $C^{20}H^{32}O^{?}$

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184. Sea Starwort – Aster Tripolium –
Watt Vol 1 429. (See 1893) Yields from ash about 68% Common salt. – Suppose this is Common Salt hay. Salt Hay –
Well two men cuts out & cut & dry about 5 tons = when dried pay 3 tons or 6000 lb.
Ash 8 & 10% – 600 lb. & 68% of the wood 408 lb salt cost roughly 1/3 & process.
Query what price salt?

---

185 Atacamite A native Oxychloride of Copper
Look this up & find out what percentage of Cu & where it comes from & what price delivered
It dissolves easily & completely in acids

---

186. Oil of Ahamantin – Watt Vol 1 430
from Root and Seeds of Ahamanta oreoselinum –
has the same formula as Oil of Turpentine $C^{10}H^{16}$
Bergamot Oil is a mixture of two oils. the more volatile of $C^{10}H^{16}$ which is isomeric with Turpentine Oil & Oil of Amara $C^{10}H^{16}O$

189. Canada Balsam contains a small % say about 6% of caoutchouc — Is this quantity sufficient to try to save it — Watts 1 492. Dec 1893.

188. Copper. Barnhardt's. Supposed Cu + Fe.
2 Cu_2S Fe_2S_3. found in a mine in Barnhardt's land + other localities in N.C. Comp.

190. Bindlime. Made from the middle bark of the holly. Boiled for 8 hrs in water till it is soft then laid in heaps in pits in the ground + covered with stones, the water previously drained from it for 2 or 3 weeks to ferment — it is then pounded to a paste washed in running water + kneaded till free from extraneous matter — then left 4 or 5 days in earthen vessels to ferment + purify itself when it is fit for use —
It may be made from Mistletoe, Young elder, etc — It is glutinous, stringy, + tenacious resembling in smell linseed oil — It dries in the air + becomes brittle — This might be good for some compound. Watts. Vol 1. 590 Dec 1893

190. Bismuth — What is the consumption of Bismuth in this country? Where does it come from? What is its price? Are there any ores of B in this country? If so are they worked? Process very simple for reduction — would it pay to start a business in producing alloys of Bismuth?

A native Arsenide of (Bismuth 3%) at. Kalmbaum W. Marienberg

Trisulphide B. Bi^2S^3 bismuth glance or bismuthine in Cumberland & Cornwall, Saxony, Bastnäs Sweden, & at Haddam Ct. associated with Chrysoberyl.

Grünauite. Jaquite. A sulphide of B & Ni with quartz & Copper pyrites at Grünau in Jaqu Altenkirchen 14.11 Bi 40.65 Ni.

Bismuth ochre. Trioxide Bi^2O^3 86.4%. Fe^2O^3 5.1% – Co^2 4.1% – H_2O 3.4%. Schneeberg Saxony – Joachimsthal Bohemia, & with native gold Beresof in Siberia

Bismuth Silver – Schapbach in Baden
" Mansfield Thuringia
x 27% Bi 33 Pb – 16 Ag 4.3 Fe 0.9 Cu 16.3 S.
" San Antonio near Copiapo Chili.
60.1% Ag – 10.1% Bi – 7.8 Cu – 2.8 As – 19.2 gangue.

191 Iodine —

Dec 1893. 50

1 The Geneseh Water Spring of Java has in 100 grams 0.0138 grams of Sodium iodide

2 The Calcium phosphate beds of the Dept. of Lot & Garonne Contain sufficient I. to give violet vapors when heated with Sulph. Acid —

3 The Sodium Nitrate of Tarapaca in Peru has in mother liquors ~~of the salt~~ 2.3 to 4.8 grams in a litre of iodine

4 Soualiadt says iodine exists in sea water as Calcium iodate & a recoverable iodine Chlorization with only 100 cc of the water 250,000 Salt Spanish produces 1 part Calc. iodate so 1 Cub. Sea mile would give 14000 lbs of Calcium iodate or 11071 lbs of iodine — 1 part of iodine in 336,610 Sea water

5 Price of Iodine resublimed 30-33 ¢ per Oz. or about $5 per lb.

6 1 Cub. Sea Mile 147.197.952.000 Cu feet = gallons.

= $\frac{15}{100,000}$ lbs Iodine per C foot = $\frac{15}{1000}$ % Cont

pumping at 1000 gall per min it would take 824,000 days.

" " 1000 g. per min 180,000 C ft per day. $135 - 27th Iod.

CHAS. BATCHELOR.

192 Jan 1894

Phenomenon remarkable.
Polarization of light through crystals of Chlorammate of Potassium
Math. Vol. 1 906.

193. Cellulose
Stones of the date contain 40 % Cellulose

194 What's Halley's Comet 1986? & when does it appear?

195 Look up Eocene - Miocene - Pliocene - Mammals - Reptiles - Saurian - Secondary Tertiary - fluviatile -

196 Tellurium
Herrerite, Altarron, Mexico - 35.58 Tell.
12.30 Nickel ox - 31.86 CO_2

197. What is the extent of increase of population in the different countries & how long would it take to so populate the world that the struggle for existence would be as great in each country as it is at present in China?

May 1894

197. What is estimated amount of Coal & how long will it take it to be used up?

198. What is estimated amount of heat in the Sun & what is yearly loss? How long will it take to reduce temperature 26 deg so that no human being can exist?

199. What is estimated solid content of sea below water surface & land above? How long will it take to erode it all to about 100 feet above sea level?

200. What is estimated amount of Iron tin, lead, & copper & at the rate they are being used how long will they last?

201. What is estimated amount of low grades of above metals & how long would they last if processes were to be found for working them?

202. In Ency. Brit. note death of
Brown Sequard, Prest Garnet. J. G. Blaine
Sir R. Burton — Helmholtz. Darwin.
Huxley. Tyndall.

203 Waste of materials June 1894 54

When machinery is being oiled there is a very large percentage of waste, fine oil cups, but not expensive like 'sight feeds' ought to be designed

---

204 Silk industry

Write to Woman's Silk Culture Assn of Philadelphia —

Kansas State silk station, Peabody, Kan — State Board of Silk Culture San Francisco — Agricultural Dept at Washington — Also see last Census on Silk Culture — for progress & value of Silk Culture in the U.S. at present time 1894

---

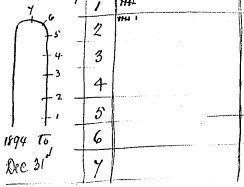
205 Soda

What is the Le Blanc process?

" " " Solvay "

What are the Chemicals used in both? & what are the byproducts? What are prices of each? & market price of product? Figure out cost & gain in each case —

206. Lamp. Edison 16 c 115 Volt 32 c. 115 V.



July 1894 to Dec 31

Aug 1894

20%.

Killed by Lightning.

During the storm yesterday afternoon Bernard Feeney, the 18-year-old son of Michael Feeney of Avenue D and Nineteenth street, Bayonne, took refuge from the rain under some trees in Kelly's woods. While there he was struck and killed by lightning. Five small burns the size of a quarter were the only marks on the body, though his clothing was torn into strips, and the soles alone remained of his shoes.

208. Salt. Aug 1894

Ashes of leaves & stalks of Nymphea alba have about 30% Chloride of Sodium See Mats Vol 4 169.

209 Mose is Glaucoma OK the 'Bannat'?

210 Write to Acheson for samples of his Carborundum OK.

Aug 1894 567

211 Get World's Fair Reports on: —
1 Chemical processes
2 Machinery
3 mining reports
4

---

212 Write Sec'y of State of U.S. for any printed matter he has on Stock Co. Sept 1894

---

213 Railroads Nov 1894

Put Railroads on map.
~~Europ~~ N America — Quebec to Lake St John
Africa — Beira to Mashonaland
S America
Mch 1895 Congo State Railrd on large map.

---

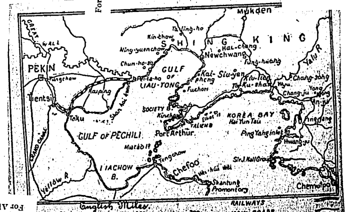
214 ~~Look up Ujina a naval port in Japan and Hirohima 4 miles from it + see what names on my Asia correspond to their~~
~~Hirohima is old Fuchima in Nippon~~

---

215 Get report on Cyprus & see if anything to put on map. Railroads etc

---

216 ~~Gazetteer says Hirohima is in the island of Honda — Mine is not what she knows~~
~~OK Honda is Nippon~~



Herald Nov 23 1894
MAP OF SEAT OF THE WAR IN THE EAST.

217 Read:— 'Lacon' or many things in few words. 2 Vols 1823. Rev C.C. Colton

— 'Beauties, harmonies & sublimities of Nature' #2 Chas Bucke (previous to 1873) —

— Glimpses of unfamiliar Japan by Lafcadio Hearn 2 Vols 1894 Houghton Mifflin & Co —

— 'The Vagabond' about 1824 (novel) Geo Walker #3

— 'Modern Philosophers' by Eliza Hamilton #4

— The Tablet of Memory Philip Luckombe 1793 #5

— Phoenix Britannicus J. Morgan 1732 — #6

218 Central Soudan RR from Algeria — Nov 1894
Col Flatters's expedition massacred by the Tuaregs, at Hairer south of Assiou
Where are these places?

219. In Herald today Railroad goes to Pei-ta-ho in my map it goes to Lung Chow which is not in same place by any means — Find out which is right & make map right if RR has to be extended —

220 Electric Light Nov 1892 58
See Ill London News Jan 1849 p. 58

221 Genius

Genius ..... Sense adapted to uncommon circumstances. attributes to Duke of Wellington

Genius is the carrying of the feelings of youth into the wisdom of maturity & age — Coleridge

Newton says his genius consists in having more patience than other men —

— Fusion of passion in thought (Who?)

---

222. NR Speed Nov. 14. 1894

Yorkshire	8.41 . 20	running
Croton	8.52 . 28	"
Yonkers.	9.15 . 20	"

---

223. Gazetteer

Ogden Mine changed to Edison Mf.

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224 Photography

For Photos get Carbutt's Orthochromatic plates about $1.50 per doz

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226 Aregrate for Sanguenay Cottage

Gracey & Co. 208 Water Street

1 Set Bricks for Fireplace $8.

1. Carlock.

226 Map.
N Y State map 6 miles per inch
about 60 x 60

227. Write Secy of State for pamphlets
& Companies.

228. Photos of Locomotives
A. P. Yates Syracuse seed
Loco 999. & De Witt Clair

229 Novels.
Get M. Crawfords OK. Dec 1894
W Isaacs

230 Books Wanted Lyell. Nov 1894
American Mech. Engineer Vols 1. 2. 3. 4.
English Mechanic Vols. 24 to 49
Society of Arts London 38 and afterwards
Nature. London Vol 40 – 46 and after
Journal of Coe Lel Eng. Vol 1. 2. 3. & 4.
N.Y. Electrical Engineer Vol 1. 9. & 10.
13 & afterwards
Amr. Loc. Elect. Eng. Vol 1. 2. 3. 9.

231 Book to read #8
Report on Spiritualism - Committee
of the Dialectical Soc. London 1871

232 Rev Wallace's ~~x~~ #9
~~x Miracles & Modern Spiritualism — Psychography & Spirit Identity x~~
~~by Mr. A. Owen~~
~~Dale Owen "Footfalls on the Boundary of another World"~~ #10

233. Coins Nov. 1894

U.S. 1¢ pieces wanted. 1800. 1801. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 66. 69. 70. 71. 77. 78.

U.S. 5¢ pieces wanted 1881. 80. 79. 78. 77. 75. 74. 73. 72. 71. 66. 65. 64. 63. 62. 61. 60 ....

U.S. 2¢ pieces wanted 1894. 93. 92. 91. 90. 89. 88. 87. 86. 85. 84. 83. 82. 81. 80.

234 Photographs unmounted Wanted Nov 1894 61

Alfred Russell Wallace. Cabanel
Henry Bessemer Benj Constant
Bougereau Alex Dumas
Gerome " " Jr.
Vibert Meissonier
Rosa Bonheur Detaille
Tesla Crookes FRS Geo Stephenson
Lewis Wick Napoleon Chas XII
Bouguet Max O'Rell Edison
Gen Grant De Lesseps Jas B Eads
Sir W. Thompson Tolstoi Massart
R Louis Stevenson Helmholtz Thackeray
Conan Doyle. Thos Paine Werner Siemens
Ingersoll Yamagata Li Hung Chang
Longanicy Cobden John Bright
J. Ericson Herbert Spencer Sir J. Lubbock
Magellan Columbus Shakespeare.
Rich. A. Proctor Lord Raleigh Sir H. Roscoe
Sir Wm Siemens John Tyndall Sir S Baker
Sir R Alcock J. A. Froude. Lionel Lynch Beale FRS
Isaac Lowthian Bell Thos Brassey Sir Rich. Burton
Rich. John W Colenso Moncure D Conway. Wm Fairbairn
~~Helmholtz~~ Huxley Justin McCarthy

235 Read.
Recollections of Past life #17 Sir H. Holland
1872 Presd Royal Inst. 9 K Dec 1894

236. Books to read #18 Dec 10 1894
A Guide to the study of English Coins
from the Conquest to present time 1880
Henry Wm Humphey — Bell & Son London

237 Dec 11 1894

MICROSCOPICAL RESEARCH has proved that the pores of wood invite the passage of moisture in the direction of the timber's growth, but repel it in the opposite direction. This accounts for a phenomenon which is often noticed, and which puzzles a good many people—namely, why two pieces of timber sawn from the same section of a tree sometimes appear to possess very variable degrees of durability. If the wood, say of a gate post, is placed right end up, the moisture of the soil will affect it, but the rain falling on the top will do little harm; if, on the other hand, the butt end of the tree is put uppermost, the top of the post will decay, because the moisture of the atmosphere will penetrate the pores of the wood more rapidly in this position. Many people have noticed that the staves in a wooden tub appear to absorb moisture irregularly, some getting quite sodden while others are comparatively dry, and apparently almost impervious to moisture. In this case the dry staves are in the position in which the tree grew, while the saturated ones are reversed.

238 Terrible storm + tidal wave Dec 11 1894
Columbia — Santa Marta — Magdalena.
River — town of Lara has completely
disappeared, occurred Dec 7th Santa Marta
capital of Magdalena inundated by a tidal
wave washing over 1/3 houses + making
people take refuge in church steeples etc.

A VOLCANO IN SERIOUS ERUPTION

Ambrym, Just Once Still on Account of Volcano
3,500 Feet High, Has Now a
Crater 1,000 Feet Deep.

News — Dec 14 1894

The Herald published yesterday morning in a special despatch from Victoria, B. C., the news of the fearful catastrophe that has overtaken the island of Ambrym, one of the New Hebrides group, in the Southern Pacific. On November 13 an earthquake shock wrecked the island from east to west, causing the land, on which stood a small native village, to slip with the huts and their inhabitants into the sea.

The outbreak began on October 16, at an old crater in the centre of the island. The lava stream after the catastrophe extended from the center to near Dip Point, the western end of the island. The centre of the island is now a mass of lava. One stream was seen by H. M. Talbert to enter the sea on the morning of October 16, one mile east of Dip Point, and from it a column of smoke arose to a height of 4,000 feet. Some of the officers of the Dart inter viewed the crater which is nine miles in diameter and one thousand feet deep.

Ambrym is reached to present a portrait of the island as it appeared in the year 1888, when the volcano, then in activity, had a height of 3,500 feet. The picture is reproduced from the illustrated London News of July 5 of that year.

239. Look out for report of H M S. Dart on earthquake at Ambryn Oct 16 1894

240 Thought transference See 1894

Take three papers with Cross marked 1–100 one for Prima, Secn & superf — Take pack cards & I look at one & think qit & they both guess — I put down on my paper & they each do same but nothing said then compare notes. & see proportion of right answers

241 Same but without one seeing the card as that is purely chance

242 Read up on thought transference:-

(Aut. & Eng) Science July 1885 diagrams by Pickering — #12

S. P. R Vol 1 # 11 #13

Mac Millan Mag. Oct 1882 Mrs Warno #14 paper

Am. Jnl Cri Jurisp July 1897 Dr Baird #15 on Gotebridge

Revue Philosophique Aug 1882 Beaunis Hypnotism #19

Discovery of [illegible] Jour Psych Jan Feb Mar 1912 #16

Look up the 'Dial' Oct. 1849 W Adams — an Engl. publication pr by Sy. #17

Books to read.

243. #20. Perpetuum Mobile — 1861 8vo Burke

244 Books to read. Dec. 1894

(21) The true Blue Laws of Connecticut
Hartford 1876. J. H. Trumbull
Public Records of Ct. (1636) 3 Vol. Astor
A-Z 1888 3824 pages.

(22) Secrets of Art & Nature - by John Wecker
1660 not in my Astor Cat.

(23) An Inglorious Columbus - E. P. Vining
not in Astor Cat. N.Y. 1885

(24) The Pentateuch & Joshua critically examined by Bishop Colenso
Astor Lib. A to D 1886 page 826.

(25) Altruism & the Struggle for life - Lowell lectures H. Drummond.
not in Astor Cat.

(26) How to make photographs in pigments
Drummond - A. J. N.Y. 1868
Astor Lib. A to D 1886 p. 1049.

(27) Wilkins Concilia time of Henry VII
Report of Abbey of St Albans -
Astor Lib. but no good as it = Latin.

243. Probabilities — Dec 1894

Guessing Red or black in cutting cards — Cards shuffled each time

50 cuts — Guessed right 25 — wrong 25

Odd + even in 120 cards dealt in 12 at a time + then cards shuffled:
Odd. 68 even 52

Red + black. in 120 cards dealt in 12 at a time + then cards shuffled
Red 53 — Black. 67

120 Cards - 10 deals of 12 cards.
Hearts 26, Diamonds 27, Sp. 26, Clubs 41,
Average should be 30 — 30 — 30 — 30

244 Lennon's death
Got date of year 1894 + put in Hayden's dict.?

245 Cyr's death for Hayden's Dict.

246. Canals Got date of opening of Manchester Ship Canal, Corinth Canal } Hayden's dict.

247 Hell + Miracles — Dec 1894

Blackwood's —

Hell
21 — 549
19 — 489

Miracles
10 — 552
40 — 91
18 — 162
18 — 113
27 — 463
25 — 100
10 — 552

248. Apparitions Dec 1894

Blk. 3 – 705 ~~Vol 6 – 201~~ Vol 17 – 570
~~6 – 86~~ " 3 – 589 " 48 – 200
~~22 – 249~~ " 10 – 249 7 – 144
28 784 ~~27 – 462~~ 29 – 361
48 326 Cotton Mather

249 Ghosts. Dec 1894

Blk. ~~20 – 192~~ ~~Vol 35 – 859~~ Vol 3 – 189
26 555 " 18 432 " 13 – 705
29 717 " 5 13 " ~~20 – 107~~
21 482 " 48. 200. 42 584
12 761

250 Second Sight:- Dec 1894

Blackwood
Vol 3 – 18 ~~Vol 6 – 204~~
~~" 6 – 63~~ " 37. 260

251 Cases from Blackwood

Lieut Sheaine Vol 26 – 347 —
Mr Stiny " 44 – 797
John Shutton " 43 227
Col. Lonsend 46 592
Ulpian ~~36 – 49~~ murder.

Cases from Blackwood

Commentaries	Vol 1	61	
Smith the Murderer	" 15	679.	
Dr Sharp.	" 20	438	
Sellis	" 43	116	
Matthew Schum	" 2	437	
Mr Rusemube	21	208	murder
Robertson	~~24~~	~~700~~	Poacher
Redmond	13.	677	
Pearcans	13	678.	
Sam Patch	50	229	
~~Patch~~ Osma	41	586	murder

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252 When binding new books remember:-

Electrical Engineer Vol VIII 1889 is only cover and index the reading is Vol IX 1890 — have this fixed. —

Eng. & Min Journal July to Dec 1891 has only got part of index see it

Eng & Min Journal Jan & June 1891 has no index

The above 3 are bound but want altering

253 Edison Gillilan ~~Controversy~~ Difference on Phonograph
1 Electrical Engineer Apl 16 1890, May 7. 1890.
2.

254 Brooks B. Notes & Q Dec 1894
There was a general index for Ser. 1-5
published in 5 Vol. in 3 8vo Squares.
Get it.

253' Brooks & Read Dec 1894

(28). A Century of Birmingham life - 1741-1841
John A. Langford - Simpkin Marshall 1868.

(29) Minerva Green (Sampson Low 1893)
1000 years hence

(30) George Wilson's 'Religio Chemici' 1862
Life of Wollaston

(31) Look up testimony of Bacaccum in Macaulay's essays.

256. Railroads (New) for maps
Biera Pungue R.R.? East & West Africa
When opened? Where it runs? etc
Columbian. R.R.

257 Edison Electric Railroads (Aug 7. 1895. 69

Jerome's letter in the Journal (Spring Boston Journal) dated Apl 16 1880. (Scrap. 1495) Edison gives Siemens credit for Railroad Elect. & then says that he supplies current to the Rails, & also says that the same current that supplies the machine can light the train also

Daily Graphic of July 27 has three cuts all showing lantern & one of them shows the lamp socket. (Scrap. 1573a)

Loco first put on about May 14 1880 & tried with breakage of friction occasionally up to 25 or so when it ran right along.

Left for Europe Feb. 5 1881. (1575 Scrap)

Left Liverpool May 12 1881 (1583 Scrap.

Edison in his testimony of infringement suit Chem. Siemens Field, System of Electro-Magnetic Railroading Tuesday Nov 22 1881 says & when asked to explain his Railroad that ~~he~~ had been ~~testified to~~ by himself & others as having ~~been~~ commenced running May 13 about 1880 ~~says~~ & then the Season says in describing it (The Locomotive etc page 89 at bottom

Same int: 192 p. Cl. Clarke says:—

258. Find place where Edison gives credit to Siemens for Electric Railway, before himself & enter it. Jennie's letter to Boston Journal Sept 1895

259. Mysterious Explosions:
Gas in an airpipe - J. P. Bayles. Eng. Vol 19. page 18.
Gas in a blower Letter p. 20 N
Gas in a gas purifier p. 21. B

260 Look up explosions in manhole boxes. in New York Streets 1880 – 1894.

261 Look up Vols 20 1891 – 1892
21 1892 – 1893
22 1893 – 1894
23 1894 – 1895
Trans Am. Min Engineers
& see if Bayles ever gave an explanation of the remarkable explosions that he described in Vol 19. page 18

262 The pig iron production of the United States for the last five years was as follows:—1890, 9,202,703; 1891, 8,279,870; 1892, 9,157,000; 1893, 7,124,502; 1894, 6,657,388. The production of 1893 decreased 22 per cent as compared with 1892, while that of 1894 decreased 6.5 per cent as compared with 1893. Jan 19 1895

Average for 5 years 8.084.292 tons

263 Books read or looked through Jan 1895 "

Wilson's Mag.

Blackwoods - Feb 1844.

---

264 Cretain for cheapwork in Brooklyn
at 20 tons per day. Jan 22 1895

15 tons scrap. at	(dol)	127.50
5 " Alice at		58.75
Fuel		22.00
Foreman		4.00
Night laborers		5.00
Office		15.00
Clipping		10.00
Shipping		40.00
Carting		4.00
Melter		2.50
" Laborers		3.50
Eng. Velset		6.50
Sand etc		5.00
Rent		5.00
Moulding		60.00
		368.75

20/368.75
18.44 per ton

price the pot $240
profit $4.00

265 Waste Substances Jan 26 1895

Their reclamations

1 — Scrap metals — Iron, brass, tin, zinc — Sheet tin: old tin cans — Platinum from Dec. Camps — copper — lead Iron turnings — Gold & silver sweepings

Get number Kerosene cans, Preserve cans ~~biscuit~~, biscuit, etc used in this country all these have all tin on when thrown away

266 Note for annual report of State Engineer Adams for fiscal year ending Sept 30 1894

267 Industrial Notes -

1 Shaping machine that cuts going backwards & takes a much larger cut without chattering than the other way

2 The use of grinding machines instead of lathes for many purposes

3 Speed of Laval turbine engine & dynamo at 30000 why cannot such a speed be utilized in some other fast running spindle work such as spinning etc

4 New method of pumping that I saw (at the Exhibition how it could be utilized

5 The fact that planing machines waste almost one half of the time makes them expensive for plain work & have much facilitated the use of face milling & revolving bed boring & turning machines for this work Whitworth made a machine that cut both ways - How many did he sell? Does he make them now? & are there any other makers in the market?

Jan 1895 76

6 The use of special lathes in doing work where many of the same kind have to be made has very much increased lately give samples of Fox lathe of 25 years ago, & some of the heavy monitors of today such as made by Matt Whitney & others — Give some data of Self acting screw mach. & their product in number.

7. The rise of drop forging — Billings & Spencer Williams of Brooklyn — M & Whitney — the extent of the business etc

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268. Design ~~and~~ bearing for Dynamos that will throw up the oil & filter & let down on shaft in a stream

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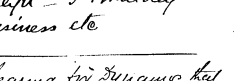
268 Mechanical Motion

Rotary to reciprocating motion Lond Engineering Aug 1894



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269 See Arts Aug 30 1892 Hyde Clarke suggests the use of the pneumatic tubes as a means of communication for short distances when the telegraph lines are down by stress of weather etc

Waste products
Utilization of animal refuse in Australia
Soc Arts Aug 9 1892
Artificial butter Soc Arts Sept 6 1892

240 Letter to Baelz, Dr. Lindgren Eng. Feb 5 1895
price of #41 Catalogue tools.

acc 1 year round	£ 6. 6. 0
#192	8. 0
314	11. 6
371	4. 0
452.	6. 0
	£ 7. 15. 6

10 % off & O.B. - will take them

241 Strength of Cast Iron. Feb 1895
I notice in Soc Arts June 13 1896 528 that a writer in a New York paper says that iron tested 30 days after casting stood 72 shockings
34 " " " " 84 "
100 " " " " 731 "
6 years " " " 2582 "
that iron cast over is very much stronger up to a certain number of fusions than the first casting Is this so??

242 Textbook on Gas Oil & air engines or internal combustion without boiler - Bryan Donkin jr London 1894
Chas Griffin & Co (Lond) £1/

273 Books
Mickey Overs & Sudbury John D. Prassard
Geo Philip & Son London price 2/.

274 Books
Freeland by Dr Hartzka about 1893

275 Doc Arts Ours commences 1853 now how were the transactions kept before that?

276 Books wanted from. London Feb 1895
Journal of the Society of Arts - London

Vol 38 Nov. 1889 to Nov 1890
" 39 " 1890 to " 1891
" 40 " 1891 to " 1892
" 41 " 1892 to " 1893
" 42 " 1893 to " 1894

Blackwood's Magazine - Edinburgh

Vol. 23 Jan to June 1828
" 26 July to Dec 1829
100 July to Dec 1866 OK. Got them
Index of Vol 51 - 100 inclusive
101 Jan to June 1867
102 July to Dec 1867 Aug 1896
103 Jan to June 1868
104 July to Dec 1868
105 Jan to June 1869
106 July to Dec 1869
107 Jan to June 1870

108	July to Dec	1870
109	Jan to J	1871
110	July to Dec	1871
111	Jan to J	1872
112	July to Dec	1872
113	Jan to June	1873
114	July to Dec	1873
115	Jan to June	1874
116	July to Dec	1874
117	Jan to J	1875
118	July to D	1875
119	Jan to J.	1876
120	July to Dec	1876
121	Jan to J	1877
122	July to Dec	1877
123	Jan to J	1878
124	July to Dec	1878
125	Jan to J	1879
126	July to Dec	1879
127	Jan to J	1880
128	July to Dec	1880
129	Jan to J	1881
130	July to Dec	1881
131	Jan to J	1882
132	July to Dec	1882
133	Jan to Ju	1883
134	July to Dec	1883
135	Jan to June	1884
136	July to Dec	1884

Ill got them Aug 1896 in London

137 Jan & June 1885
138 July & Dec 1885
139 Jan & June 1886
140 July & Dec 1886
141 Jan & Jun 1887
142 July & Dec 1887
143 Jan & Jun 1888
144 July & Dec 1888
145 Jan & Jn 1889
146 July & Dec 1889
147 Jan & Jn 1890
148 July & Dec 1890
149 Jan & Jn 1891
150 July & Dec 1891

Not these in Aug 1896

Index for Vol 101 & 158 inclusive

Corr. wrgly this on these

151 Jan & Jun 1892
152 Jul & Dec 1892
153 Jan & Jul 1893
154 July & Dec 1893
155 Jan & June 1894
156 Jul. & Dec 1894

Notes and Queries. A medium of intercommunication for literary men, general readers etc.

Any volumes bound or unbound included between Jan 1886 & present time

The Philosophical Magazine by
and Journal of Science ~~Alexander Tilloch~~

Series 1
Vol 21 – 1806 – London Taylor & Co
to Vol 68 – 1826 inclusive

Series 2
Vol 1 to 11 inclusive 1827 – 1832

Series 3.
Vol 30 Jan to June 1847
" 31
" 32
" 33
" 34
" 35
" 36
" 37 — 1850

Series 4 – Jan to June 1852
Vol 3 to 14 inclusive July to Dec 1857
" 16 to 50 " 1851 to 1875
July to Dec 1858

247 Card trick Feb 1895.

Eight Kings threatened to save nine fine
8 K 3 10 2 7 9 5

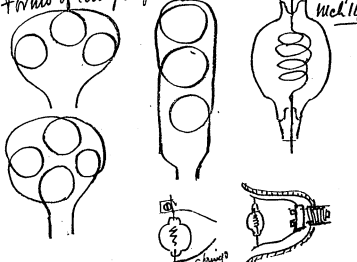
Ladies for one sick Knave.
2 4 1 6 Kn.

---

248 Look up Journal of Optician Society
Founded by Penn 1818 a descendant
of Wm Penn

---

249 Forms of lamps for effect + economy 1895 Mch 14.



280 Taxes 1894.

38 West 25th St.	496.	25
Mesnil	106	34
Glen of Park	30	58
Newark W. 6 & 2 Av.	5	44
" 144 Plane St	53	80
" Hamburgh Pl.	11	49
Fort Platist, Mich.	5	04
Schenectady	1	00
Tacoma	22	43
Brooklyn	35	00
	764	70

1895 Aet 23

281 It seems to me that it is frequently the case that when one discovery or great invention is made there is generally another follows close on it as for instance

Argon and Helium by Rayleigh & Ramsey new elements

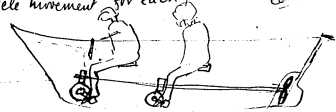
Telephone by Bell & Phonograph by Edison both in Acoustics

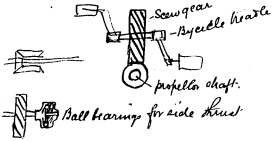
This is probably owing to the fact that a new line of thought has set many minds to work independently & each following his own ideas arrives at different results

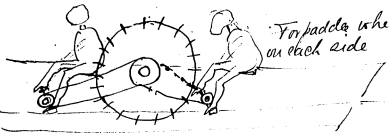
Look up more cases.

282. Pleasure Boat

Bicycle movement for each person June 28 1895 @13.







Compressed air could be used with small engine on propeller — Air to be compressed at home and put in cylinders all along under seat and if it run out two or three hand pumps to compress again to be able to get home

Work this out: a boat 30 feet long could have 50 feet of 12" cylinder or about 3½ cubic feet cap

May 1895 83

283 Launch motor

Some success[illegible] being made in various places with the new nautical motor by which any boat, say from ten to eighteen feet long, can be transformed into an electric launch without any alterations, simply by screwing to the stern of the craft a fitting similar to a rowlock plate, the motor being attachable at once and easily. From the tip of the tiller to the screw the equipment for this purpose, as explained, is 3½ feet long. About 18 inches of this length, consisting of the motor, controlling lever and tiller, are inboard of the sternpost, that part which runs outboard being simply a nickel-plated two-inch shaft tube, the weight thirty-five pounds, and the battery for running being from seventy-five to two hundred and seventy-five pounds, the weight varying with the choice of a primary or storage battery. The two-bladed screw is of ten inches diameter, and, just forward of this on the shaft tube, there is located a steering fin, both motor and steering gear being thus combined in the same machine. By means of this arrangement from one-third to one-half an electric horse power is developed with four four-cell batteries giving twenty-six volts, and, as stated, from three to five miles an hour is the result, according to load and resistance.

284 Effect of moon on tides

The following is given in brief as the theory most generally entertained by scientists, with a few exceptions, concerning tides: It is assumed that the moon, acting alone, would not only raise a wave on the side of the earth nearest to it by gravitation, but would also draw the earth itself far enough out of its course to leave behind some of the water on the further side, which water would then be raised relatively to the earth's surface and constitute the second tidal wave; the sun alone would act similarly, although its tide-raising effect is only about two-fifths that of the moon. Now, at new moon, the sun and moon "pull together" and give higher tides than at the first and third quarters, when the sun draws its right angles to the line of the moon's attraction, and, at full moon, when the sun is on the opposite side of the earth from the moon, virtually the same effect is observed as at new moon; but the double tideraising action of the sun would again be super-imposed on that of the moon and give tides on opposite sides as high as those a fortnight before.

285 Bicycle.

This bicycle craze is a craze indeed. Men, women and children have taken to the wheel, and it is dangerous to cross the streets. I have just heard of a country church fair, and for what purpose was it gotten up, do you think? Why, to buy the pastor a bicycle. Now, I shall be called a rank heretic, and some of you will be indignant enough to throw paving stones at me, but, in very truth, the bicycle is a clumsy and ungainly affair. Of course the crazy people will deny this, but they know it to be true, nevertheless, even in their craziest moments. What then? Well it will soon give way to something better. It is well enough as a stepping stone, but as a resting place it would be deplorable. It will be evolved into a horseless carriage, driven by electricity, and it won't be ten years, perhaps not five, before it will give way to a vehicle that will be safe, will go at great speed, and be comely to look upon. Then we shall look at the present bicycle as a frog looks at a tadpole. Pardon, a thousand pardons, but those burning thoughts must have vent.

250 Words

	Letters	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
Feb 8. 1891	1220	93	20	46	49	155	28	22	65	92	0	3	41	36	87	82	32	1	83	76	129	41	3	29		25	2	Tribune Editorial — Times of Latrine —
July 15 1895	1161	78	15	39	36	56	30	16	78	73	1	2	37	22	89	100	32	2	74	72	118	40	2	14	5	21	0	Herald Editorial — Relief for Ireland
Sept 2 1898	1129	92	21	29	45	150	27	21	65	69	1	7	39	20	66	90	18	2	70	65	110	42	16	27	1	27	3	Herald. New Blood hero

284. Electric Light — May 1895 25

May 20 1853 – One of the Citizen steamers went from Chelsea to Gravesend at 9 pm. with an electric light on each paddle box. See Arts 1853 p. 323.

See London papers about this date

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288. Inventions — May 95

See Arts Vol 2

---

289. See when United Service Journal (1829) started and stopped.

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290 Mechanical motions.

R. Webster gravity escapement

See Arts 10. 443

---

291 Platinum light. See Arts. 1870 Vol 18. p. 553 Platinum in H. and Carb.ic Oxide gives a light 26% better than Gas.

X

292 Platinum Elect. Light

Silliman's Journal 2d Ser. 4. 1847

Mr Draper's exp. on heat & light from Pt. Also Phil. Mag May 1847.

X

Also
Salem, Mass. Observer Nov 2 1878.
Note - See if you can find any paper that gives account of July 1869 at Salem Mass of exh.^n at M. G. Farmer's house. - See Boston papers of that date.

July 1895

298. Incan.^t Lamp.
A. Lodyguin - Petersburgh -
Carbon conductor in glass globe for lamp. See Russian paper Colos. #220. May 11-23 1893 - trans.^d in Sci. Am. Aug 22. 1893 Vol. 21
H. H. Whalen in Sci. Am. Apl 11 1893. 398
Dayo:
Patent (Eng) 10919. Nov 4 1845 is to King (C. C.) see it!!!
1848. Staite tried inc.^t irritium in Globe.
1850 Mollet. Incand.^t Carbon in an exhausted globe and driven by magneto.
1852. Martin (J. Roberts) Graphite in exhausted glass globe.
See Telegraphic Journal Vol 7. 119 apl. 1. 1879. Hadek's idea of using carbon for incandescence in place of any thing else.

203 Cont'd

See Phil. Trans. of Roy. Soc.

164 (1874) page 501
165 1875 " 519
166 1876 " 316
169 1878 " 244

See also. Lydal Heal as a mode of Ignition 4th Ed. 428-9. on Jet Burners.

See also U.S. Pat. 211,262.
Sawyer & Mann Jan 7 1879

See also. Telegraphic Journal London Jan 1 1878. Article on State of Elect. Rl. — I think he talks all about arc & does not consider incandescence of sufficient importance to mention it.

See also:- U.S. Pat. Sawyer granted 1877 Aug 14 & filed June 27 — another a week later Aug 21 1877 Elect. Lamp or Burner.

Also see:- U.S. Pat. 196,834 Nov 6 1877 Sawyer. Also see. 196,111
Also see. 205,144 Sym. June 1878.

Also See 205,303 June 5 1878
& 205,305 " 25 1878

Also See:- N.Y. Sun Sept 11 1878
" " " " 16 "
" " Tribune " 28 "

Also See:- Report of Secy of Navy Washington

Cont.
1876 p. 161 Rept. of Chief. of U.S. & Sec of Navy.

Also see:- N. Y. Herald Oct 12, 1878.
Also see Scribner's Mthly Feb 1880 p. 534 Upton.

Also see:- Edison's patents
Apl 1879. 214 636
" " 214 637
Aug 26 1879. 218 866

Also see:- N. Y. Sun Nov 25. 1878

Also See Maxim Pat. U.S. 247 380
Sept 30 1881

Also See Interference Maxim Vs Edison
Maxim 247 380
Edison 214 636
current regulations 1881

Also See Herald Dec 11 1878
Commr. Advertiser Nov 23 1878
N. Y. World Dec 23 1879
N. Y. Sun Nov 25 1878.
N. Y. Herald Nov 22 1878
(Barker's article)

Also See: Lane Fox (Eng Pat) 3988. 1878
(High resistance in Camps)

Also See:- Ed. 227 229. May 4. 1880
Appl. for Apl 21st

Also See 'Engineering' Apl 19. 1878.
(Crooks experiments.)

Cont'd.

See also. Evidence of Mann & Church in Int.e S & M. Vs Edison

See also:- N.Y. Times Mch 19 1878 Sawyer Patents

See also:- U.S. Patent 211262 S. & M. Jan 7 1879.

See also: N.Y. Eve. Post Oct 30, 1878 Scientific Am.n Dec 7 1878. S. Amp N.Y. Herald Dec 21 1879.

Also:- Edison filed Dec 11 1879 pat. for paper carbon

See also:- N.Y. Herald Mch 25, 1880 Barker's figures

See also:- Journ.l Franklin Inst. Phil. Mch 24. 1880 Barker's lecture

See also:- Sci.c Am.n Apl 17 1880. Investigation of lamp by Morton Mayer & Thomas Also Vol. NS. 42. p. 243.

See also:- N.Y. Sun June 14 1880

See also ~~U.S. Pat~~ Soc. of Arts. Dec 8 1886. Weber article Hydrocarbon treatment

See also:- Sci. Journal & Elect. Review 19. p. 593.

See also. Eng. Pat 4847. 1878. Cheseborough. for Sawyer Mann treatment

See also:- N.Y. Event Pat Nov 12, 1880.

Cont. = 1879 July 1895 89

See also. Electrotechnische Zeitschrift
Nov & Dec 1885 on Flashing

See also Swan patents in O.G.:-
233445 Oct 19 1880
234346 Nov 9. 1880 these are all
up to July 27. 1882

See also. fundamental pat. for Edison for Lamps
223898 Jan 27. 1880
227279 May 4 1880
230225 July 20 1880

See also what Swan claims July 28 1882 at
the preliminary hearing before Mr Justice
Chitty. London.

See also.- Royal Society 1848. June Siemens
platinum burner.

See also: Farmer's letter to Wilde Manchester
Philosophl. Soc. About Oct. 1866

Look up also. Gardner & Bloxom Regual Lamps
plat. wire -- previous to 1865

Look up also King & Staite & others — Carbon bars
in sealed globes previous to 1865

Look up Kabloff's experiments

Also read up.- Present State of Electric Lighting
James N. Shoolbred before Brit. Ass.
Aug 1848.

Also. Gas illumination. Dr W. Wallace — See Ass.
Vol 24 Jan 31. 1849.

204 Butler in Hayden's D'c

Deaths. Edmund H Yates May 20 1894
Oliver Wendell Holmes Oct 7 1894
John Lothrop Motley May 29 1877
Brigham Young. 29 1877
Victor Emanuel II Jan 9 1878
Pius IX Feb. 7 1878
Earl Russell Born 1792 died May 28 1878
Prof. Henry May 13 1878
OK Photo ~~W. C. Bryant.~~ ~~June 12 1878~~
Prince L. Napoleon June 1 1879
Jules Favre Jan 20 1880
Czar Alex. II Mch 13 1881
Pres Garfield July 19 1881
Gen Garibaldi June 2. 1882
" Skobeloff. July 7. 1882
Leon Gambetta ~~Jan 1 1883.~~
Leon Kennett Mch 24 1894

Richard A Proctor Born		died
Dr Werner Siemens	"	"
Sir Wm Siemens	"	
Robert L. Stephenson	"	Dec 3 1894
John Tyndall	"	
Alfred Russell Wallace	"	
Charles Darwin	"	
Jas Ant. Froude	"	
Sir H. Bessemer	"	
Sir R. Burton	"	
Wm Fairbairn	"	
Prof Helmholtz Herman F.	"	Sept 8 1894
Prof Huxley	"	June 24 1895
Brown Sequard		Apr 2 1894
Ferd De Lesseps		Dec 7 1894

Sept 1895 91

295 Books to read, -- about Inventors

'The Impregnable City' by William Pembertn
Dodd Mead & Co. N.Y.

'Actual Africa or the Coming Continent'
by Frank Vincent -- D. Appleton & Co. N.Y.

'Social Diseases & worse remedies'
Rev. Hussey

'Sarat Chandra Das. 1881 on Thibet

'Atavism & Evolution by Prof. Lombroso.

'Aerial Navigation' by Salvendia

Hubert's Inventors Ok Sept 1895 at Poughkeepsie Library

Apparitions & Thought Transference Podmore

Remarkable inventions Bakewell F.C.S. N.Y. 1860
8° Ok Sept 1895 at Poughkeepsie Library

Beckmann John. Inventions discoveries and
origins Lond. 1846. 2v 12° Ok Sept 1895 at Poughkeepsie Library

Library of Amer. Biography 1839-1848 25 Vols
Look this up for inventions J. Sparks editor

'Our Living representative men' 1860 J. Savage.

Representative men of N^d & S^th 1874
Rogers A. C.

Biography of eminent Am^n Persons 1857
B. J. Lossing

Lives of Eminent Ind^s celebrated in Am^n history 3 v. 1847 T. H. W. Edelen

---

Lives of Eminent Literary & Scientific men of America 1850 Wynne J.

Biographies of Scientific men 2 v.
F. Arago.

Mem. of Am^n Mechanics; Lives of European mechanics 1841. H. Howe

---

Lives of eminent literary & scient^c men of early Cyl. Britain 1840 (Anon)

Industrial biography, iron workers and tool makers 1864 Smiles Sam.

Biographies of self-taught men 1832
" " " " " 1859
B. B. Edwards.

Curiosities of human nature 58 Biog^l Sketch, 1845 Goodrich S. G.

Mem. of Celebrated Characters 2 v. 1854
A. De Lamartine.

Biographical sketches 1869.
H. Martineau

Biographical Sketches, 1863 Senior N.W.

Self made men 1858. Seymour C.C.13.

Pioneers' Biog. Sket. of leaders in various paths 1861 A. L. Simpson.

Wonderful characters 1854 Henry Wilson

Life of R. Fulton N.Y. 1817. C.D. Colden

Tapetum mobile London 1861 12° H. Dircks

Triumphs of invention & discovery 1861 12°
Life J. H. OK Sept 1875

Mem. of Amer Mech N.Y. 1841 12°
Henry Howe

Life of James Watt. N.Y. 1857. 12° J.P. Muirhead

Penny Cyclopedia of the Soc. for the diff. of useful Knowledge Vol 1 1833 & others London 4°
OK gotu

Penny Magazine London Vol 1 1832.

Million of facts N.Y. 1836. 12° Phillips Sir R.

Life of Geo Stephenson Boston 1858 Smiles Sam

Steam & Engines. London & N.Y. 1856. 12°
Routledge R.

Story of inventions of Steel pens. N.Y. 1890. 16°
Bore Henry

Inventions and devices 1578 Wm Bourne

Century of Inventions ~~Marquis of Worcester~~

296 Books to be sought for information! — Sept 1895

Canals of the U.S. by H.S. Tanner.

A Voyage down the Amoor. 1860. N.Y. 12°
Perry M. Collins

Our first century — 100 events Springfield
1878. 8°. R. M. Devens.

Coal, petroleum, & other dist. Oils. N.Y.
1865. 8°. Abraham Gesner.

Letters on Animal magnetism Phila 1851
12° Wm Gregory.

'Animal Magn: or Physochodunamy. N.Y.
1846 12°. Fher Leger.

History of a mouthful of bread. 1868. 12°
Jean Macé

Repository of entertaining & useful reading
N.Y. 1843 16°—

Human Voice James Rush Phila 1833 8°

Magic of the middle ages. – Transl. by A.H. Edgren N.Y. 1879. Victor Rydberg.

Philosophy of magic – trans.d by A.J. Thompson 2 vol. London 1846. 8°
Eusebe Salverte

Economy of mach. & manufac. 1832. 16°
Char Babbage

Animal Magnetism Alfred Binet & Charcot N.Y. 1888. 12°.

Dictionary of Miracles Phil.a 1885 12°
E. C. Brewer

19 Cent. Miracles N.Y. 1884. 8°
Emma H. Britten

Leviathan London 1886. 12°. Thos Hobbes

Microcosmus N.Y. 1886 2 vol in 1 8°
Herman Lotze

Hypnotism N.Y. 1890. 12°
Albert Moll.

Reconstruction of Europe N.Y. 1890. 12°
Harold. Murdock

Gatter. on Coal gas by W Clegg carefully in the Centuries

pamphlet 1816. Prospectus of a company "a Natural Light & heat a 97 Patent" demonstrated by the patentee Wm Winsor

Sept 1895

294 Large building stones & blocks.

Ruins of Baalbec — Dulthin or three stones temple so called from three blocks of ~~such~~ the remarkable dimensions namely:—

64' X 13' & presumably square
63'8" X 13' "
63' X 13

These have been raised 20 feet from ground Enc. Brit - 9th Edn reprint. Vol 3 p. 147.

Mark Twain in his 'Innocents abroad' says that one block still remains in the quarry near the above temple & of measures 14' X 14' X 70 feet less a few inches — at 168# per cubic foot = or 1400 tons

298 To fill on cracked hard wood floors:
= Paper pulp and fine sawdust boiled together for hours & minced with glue dissolved in linseed oil — Put in & leave until partly dry then cover with wax & smooth off with hot iron

Sept 1895.

Sept 1895 97

299 Hoosac Tunnel —
Sci Am^n Sept 21 1895 says:- "No message has ever been able to have reached down through the tunnel 4½ miles long but they have been an over tunnel [illegible] In working the tunnel they found no metal or [illegible] North Adams is plugged at [illegible] this of course is quite singular — find out cause —

300 Lucy transatlantic Steam Eng^ing
Sam. Ward Stanton's paper in Engineering for Sept 1895 — extracts of it in Sci Am^n Sept 21 1895

301 XIX Century 50¢ per month London
Sampson Low Marston & Co
Leonard Scott pub. Co. New York

302 Books to get. Oct 1895
"Mesmerism Spiritualism etc" by Dr Carpenter.

Hypnotism by Ernest Hart.

303. Oct 19. 1895
Fix Rosa's lights — Skin the plug on one side gone in cellar as Emma's lights are gone also on one side.
OK, Oct 25 1895

304 Put rubbers on shutters in front basement Screw them on. Oct 19 1895

305 Fire dumb waiter Oct 20 1895

306 Pin for hands of clock in dining room Oct 21 1895

307 Buc But. 1878 & 1888 Vol 1 & Vol 23. Scribner's

308 New York Notes. Oct 21 1895

The cable on Lexington Ave was started and cars run for first time Sunday Oct. 13 95

The 9th Av. Elevated road commenced to run by cable — July 2d 1867

dits by locomotive — —

The 6th Ave by Ives. —

the 3 Ave by " — —

the 2 " " " —

The Lenox Ave line by underground trolley from opened July 9 1895 but cars had been run before that all everything O.K. Scrap.

309 To make a continuous diary to go with Pepys + Evelyn Get: —

Court of Louis 14th by St Simon

Civil wars of the Fronde by Cardinal Retz.

Charles the 1st by Lucy Hutchinson

Charles II by Clarendon and Pepys.

George II by Lord Hervey

" " Horace Walpole

Geo III by Madame D'Arblay
Geo IV + Wm IV by Greville

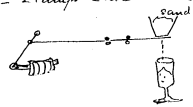
Nov 1895

310 See
Mr. Borchers – Experiments on the utilization of the Chemical Energy of Carbon as Electricity – Beibl Vol 19 No 4 p. 346
What journal ???

Nov 1895

311 Try the effect of rubbing Aluminium, Magnesium Cadmium & Zinc on clean glass

312 Electric Meter (copied from old paper) Nov 1895
Oct 18 1890 – Ampere meter works series of strokes – 1 lamp opens one hole + the other runs – 2 lamp 2 holes + so on



Quantity in glass measure work alone.

313 Alloy for vessels that acid + alkaline solution are put in

Copper	15. pts
Tin	2.54
Lead	1.82
Antimony	1.00 g.

Copied from old paper Feb. 21 1899

314 Bunge dip. Nov 1895

Bath Muriatic Acid	3 oz.
Nitric "	1 oz.
Chloride Iron	1 oz.
Arsenic	1 oz.

When dissolved add Water 1 oz.

---

315 Bunge dip – Muriatic Acid 5 oz.
Nitric " 2 oz.
Powdered Cobalt 1 oz.

Nov 1895

316. Reader Bound in Cupboard #1
for 33 Phil Mag
Vol 34 Philosophical Mag —
" 35 " "
" 36 " "
" 37 " "
" 38 " "
" 39 " "

Vol 1 Cassiers Mag.
" 2 " "
" 3 " "
" 4 " "
" 5 " "

Vol 6 Cassier's Mag.
" 8 " "

Vol 13 Scribner's Mag. Want title page + index
Vol 14 " " " " "
Vol 9 " " Jan + June 91.

Index Journal Lel Eng. London. Vol 11 & 20.
Vol 22 " "
" 23 " "
" 21 " "

Vol 17 Cosmopolitan Mag.
" 18 " "

Vol 12 Murray's Magazine

Vol 1 Quarterly Illustrator

See #334

102

31. New York Real estate prices

1 [redacted] W. 76th St. #21 Nov. 1895 $62.500

3

2 The most interesting private transactions embraced property near Herald square. Brooke & George sold for Archibald D. Russell the four story brown stone front building, on lot 25x98.9 feet, which he bought recently for $63,000, for $74,000; and for Jane L. Brooke No. 38 West Thirty-second street, a four story building, 20.8x98.9 feet, for $66,500. William Hall's Sons purchased for $56,000, both houses, the purchaser, who purchased for a long term of years on No. 39 West Thirty-second street, and he leases from Addison Cammock No. 40 West Thirty-second street, and Nos. 39 and 41 West Thirty-first street.

William Hall's Sons purchased for $56,000, from the Coleman estate, the block front, on the west side of Lexington avenue, between Ninety-seventh and Ninety-eighth streets, 25.10x105. The same firm of builders bought the east front of the avenue between the same streets last week.

Lexington Ave.

38 West 32nd $66,500

3 [redacted] Nov 8. 72 W 36. $45.000

4 Colonel Edward A. McAlpin yesterday made one of the most advantageous sales yet concluded in the district to the south of Herald square, which has been so active recently. He sold, through J. Romaine Brown & Co., to Andrew J. Conniff, No. 3 West Twenty-ninth street, a four story dwelling on lot 25x98.9, for $90,000. Mr. Conniff will probably alter the property for business purposes.

Nov 27 1895 9 W 29th St 25x98.9. $90.000

5 McIlvile Langdon sold to a Mr. Ashe No. 44 East Seventy-sixth street, a four story brown stone front dwelling, on lot 20x102 feet, for about $32,500.

Charles Griffith Moses sold for Florentine

Nov 27 1895 44 E. 76th St 20x102. $32.500

Letters

Edison 351 – 417 – 448 – 469.
Israel 352 – 460 – 464 – 466 – 467 – 469 – 471 – 472 –
Couch 353.
P M R B 354. 395 – 403. 413. 416. 440. 458.
Wallington 355 – 415 – 446. 459
Passions 364.
C C Campbell 365 –
Vanicelen 368. 372.
Keasby 369 – 396 – 458
Steinberg T M 373. 382 – 456
Wallis 378 –
Atwood 379 –
Kruesi 380. 423. 426. 451
Fryer Cole. 381.
Ord. 395. 399. 412.
Newark Water works 389.
Sam Meyer 394. 419. 421.
Wm. Beach Club House 397 – 448 –
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Rly. Ward 411
Carlincen Redak 410
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Wurdes Rd. 430. 439
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Sel tric } 434
J H. Wood. 433.
Cornish 435
John K Wallace 441.
Rd. A. W. Cooley 442.
De Remer 447 – 462 – 463 – 468 – 470 – 472.
Sotheran 449
Wm St Ry 450
Aug Kruesi 452
Pierce 454.
Hammer 454
Adg Lopez 456

Bureau Statistics 457.
Zylon 461.

Charles Batchelor Notebook, Cat. 1237

This notebook covers the period March 1880-February 1884. There are also a few entries for 1894 and 1899. Most of the entries are by Charles Batchelor. The material relates primarily to electric lighting, particularly dynamo design and lamp tests. Included also are calculations for a Paris central station, drawings and notes from 1899 pertaining to a filter mask designed by Batchelor, and copies of correspondence about cost estimates for central stations. The book contains 284 numbered pages and has been used in both directions.

Blank pages not filmed: 148-153, 216-275.

Missing page numbers: 9-10, 13-14, 17-18, 21-49, 51-55, 131-134.

Filming order: 1-215, 283-276 [in reverse page-number order], 284.

E 5873-7

NPS CAT #1237

N-80-03-08

Estimates for dividends on Electric Lighting

Preliminary estimate of the cost of lighting 10000 electric burners from a central station each burner giving a light equal to 16 candles, or taking the place of a gas jet consuming 5 cu. ft per hour —

Five hour use of each burner is assumed as the average for the year — In taking this figure it was remembered that during the day a large number of lights are used in dark rooms and during nights a still larger number are used from 8-12 hours — A gas jet which consumes 5 cu. ft per hour burning 5 hours will consume 25 ft per day or about 9000 cu. ft per year. Equivalent of 1500 ft of gas is designated as an M — that is 10000 burners 9000 M's per year — Tests show it possible to obtain 8 lights per HP consumed by the belt — So 10000 lights 1250 HP is required

Investment		
Boilers & chimney (8 HP)	$21.000	
5 Engines (8 HP's)	42.500	
Foundations	2.300	
Structure	7.000	
Shafts pulleys &c	3.900	
Belt — — —	24.700	
Wood flooring &c	8.000	
	$83.700	roi

2

Water heater & pump	83.700
	7.000
Iron floor & boiler supports	6.000
Faradic	24.000
Conductors	50.000
	$169.700 Total investment

Total investment per M $1.84

Depreciation:—

Arch & Chimney	10%	21.00
Engine	3%	12.45
Foundation	1%	.23
Iron structure	2%	1.40
Shafts pulleys etc	2%	.77
Belts	10%	4.70
Wood flooring etc	5%	1.50
Water heater pumps	5%	3.50
	2%	1.20
Boiler floor	5%	7.20
F. Machine		
Conductors	2	1.00
		$62.45

Annual depreciation per M $0.0714

Labor (Stoking included under coal)

Per day	2 Engineers	$6
	2 Firemen	10
	2 Helpers	3
	2 Regulators	3
	Occasional ½ the	22
		$44
		$33

or per M $0.132

It is recommended that a small amount be charged each year for fuses, sufficient to pay for fuses etc.

Coal:—

Best coal is taken as costing $3.50 a ton under the boiler, that is, including labor of stoking; 3 lb. coal an hour are required for one H.P.

$2.930 for coal per day
or 0.117 cts per M

Water for boilers, waste oil etc Estimate as costing ⅓ of Coal

.039 cts per M

Rent:—

$1000 per year for cellar & first floor of a building 100 x 50 feet in any locality near the place where required

$0.111 cts per M.

Summary:—

Depreciation	.0714
Labor	.132
Coal	.117
Water	.039
Rent	.111
	.470 cts

Cost of light delivered to consumers Exclusive of taxes.

Selling light alone the dividends will be

at 50 cts per M.	1·5 %
" 60 cts " "	6·8
" 75 "	14·7
90	22·6
1·00	30·5
1.25	41·0
1·50	54·

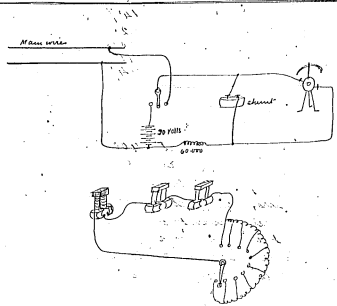
Power estimate.

It is estimated that 400 H.P. can be sold during the day for various purposes small shops, elevators, lathes, sewing machines, pumps etc. 10 hours average use of this amount is assumed.
The cost will be simply the cost of coal under the boiler and water etc.
$2000 will have to be invested in additional conductors. Power is sold today in N.Y. at $150 per year or 5 cts per hour or at the rate of 5 cts per M. — Electric power has the advantage that it costs only when used.

When light and power are used at

50 cts per M	dividends of	11 %
75		33 %
100		59 %
150		90 %

Regulating device for Central Station



Photometric Measurement

One of our large lamps in order to give an average of 16 candle power all round must give about 22 on its face

Wed 8 1880

REPORT OF COMPARISON BETWEEN THE PRONY AND EDISON DYNAMOMETERS, AND UPON THE EFFICIENCY OF THE EDISON DYNAMO-ELECTRIC MACHINE, BY PROFS. C. F. BRACKETT AND C. A. YOUNG, OF THE COLLEGE OF NEW JERSEY, PRINCETON, N. J.—EXPERIMENTS MADE APRIL 3, 1880.

FIRST COMPARISON BETWEEN THE DYNAMOMETERS.

The lever arm of the Prony was held down by the action of a spring balance applied at division 12, corresponding to a virtual circumference of 13 feet. The weight of the balance was 5·41 pounds, which is to be added to all its readings. The balance was read by Mr. Upton. After the experiment, the Edison dynamometer, transmitting no work, as read by Prof. Brackett, indicated (the mean of five readings, ranging from 990 to 995) 994·2 pounds. During the experiment the readings were made by Prof. Brackett and recorded by Prof. Young.

Duration of test, 10 minutes.

Number of revolutions of Prony shaft, determined by counter, 3,664.

Number of revolutions of main shaft, 1,880.

Mean indication of Edison dynamometer, deduced from Prof. Brackett's ten readings, varying from 920 pounds at beginning to 935 at end of experiment, 923·7 pounds.

From this, taking the mean reading of the zero, 994·2 pounds, we have $\frac{994{\cdot}2 - 923{\cdot}7}{2} = 34{\cdot}25$ pounds.

Mean tension on Prony arm, 9·011 pounds, varying gradually from 10·91 pounds at beginning to 7·06 pounds at end of experiment, including weight of scale.

Work registered by Prony, 9·011 (lb.) × 12 (ft.) × 5,664 (rev.) = 612,409 ft. lb.

The diameter of main pulley is 38 inches.

The angle between belts of Edison dynamometer is taken at 44°. Assume $K = \left(\pi \times \sec. 22° \times \frac{38}{12}\right) = 10·7297$. Then the Edison dynamometer registered K (ft.) × 1880 (rev.) × 34·25 (lb.) = 690,880 ft. lb. That is, the Prony recorded 88·6 per cent of the work carried by the Edison dynamometer.

The comparison does not seem to us satisfactory on account of the considerable change in the conditions during the experiment.

SECOND COMPARISON.

Constants and observers as before.

Duration of test, 4 minutes.

Number revolutions of Prony, 2,281.

Number revolutions of main shaft, 752.

Mean tension on arm of Prony, 11·85 lb., varying from 11·50 to 12·97 in seven readings.

Initial reading of Edison dynamometer (mean of five), 914·2.

Final reading of Edison dynamometer (mean of five), 994·2.

Mean during comparison, 911·57.

(Mean of seven readings, varying from 910 to 915 lb.)

Work according to Prony, 11·85 (lb.) × 12 (ft.) × 2,281 (rev.) = 810,030 ft. lb.

Work according to Edison instrument, K (ft.) × 753 × $\left(\frac{994·2 - 911·57}{2}\right)$ = 833,360 ft. lb.

In this comparison the Prony registers 93·2 per cent of work indicated by the Edison dynamometer.

We regard this test as fairly reliable, the conditions having been very constant, and the outstanding difference of 6·8 per cent being reasonably accounted for by slip of belts and friction of journals between the two dynamometers.

TESTS OF THE EFFICIENCY OF THE DYNAMO-ELECTRIC MACHINE.

During both these tests the thermometer of the calorimeter and the Edison dynamometer were read as often as every minute, and great pains were taken to keep the water thoroughly stirred. The calorimeter was a galvanized iron vessel, 16·42 inches in diameter and 24½ deep.

The wire coil was wound upon a light wooden frame, so constructed as to serve as a very efficient stirrer.

The thermometer was an excellent instrument, by James Green, graduated to fifths of a Fahrenheit degree, each degree being about three-sixteenths of an inch in length.

Prof. Brackett read the dynamometer.

Prof. Young read the thermometer and made the records.

Mr. Upton and others, the speed of the main shaft and the indications of the high resistance galvanometer in the laboratory.

CONSTANTS.

Weight of calorimeter (empty)	22·63 lb.
Heat capacity of same (taking specific heat at 0·112)	2·53 lb.
Weight of wooden frame	5·71 lb.
Heat capacity of frame (s. taken at 0·09)	1·71 water lb.
Weight of wire coil (84½ turns, each turn weighing 5·84 grammes)	0·70 lb.
Heat capacity of wire (s., 0·16)	0·07 water lb.
Resistance of coil in calorimeter	1·720 ohms.
Resistance of leading wires taken as $\frac{1}{18}$ of coil	0·0957 ohm.
Resistance of wire on revolving armature	0·140 ohm.
Resistance of coil on field magnets	1·470 ohms.

FIRST TEST.

Total weight of calorimeter with contained water and everything in place	197·5 lb.
Hence from preceding data the heat capacity of whole	172·77 water lb.
Temperature of air	73·2°
Temperature of water at beginning	63·8°
Temperature of water at end	80·0°
Gain during experiment	16·7°
Duration of experiment ...13m. 50s.	13·83 m.
Dynamometer at beginning (free)	994·2
Dynamometer at end (free)	995·
Mean dynamometer zero	994·6
Speed of main shaft, beginning	174 per min.
Speed of main shaft, end	170
Mean	172
Mean reading of dynamometer during experiment (Varying from 760 to 781, 16 readings.)	771·75 lb.

E. M. F. of current maintaining field was 61 divs. of galvanometer, on which 168 d. corresponded to 16 Daniell cells, *i.e.*, E. M. F. $= \frac{61}{168} \times 16 \times 1·079$ volts.

Energy expended on driving armature, as indicated by dynamometer = K (ft.) × 172 (rev.) × 13·83½ (min.) × $\left(\frac{994·6 - 771·75}{2}\right)$ = 2,844,609 foot pounds.

Energy expended on field of force, $\frac{6}{5} \times \frac{45·25 \text{ (ft. lb.)}}{1·47 \text{ (ohms)}} \times 13·83 \text{ (m.)} \times \left(\frac{61}{168} \times 16 \times 1·079\right)^2$ = 10,634 foot pounds.

Hence, total energy expended, 2,864,324 foot pounds.

Energy Realized.

a. In calorimeter = 772 × 172·77 × 16·7° = ... 2,227,420 ft. lb.

b. In leading wires $\frac{1}{10}$ of above... 7,423 ft. lb.

c. In armature $\frac{14}{172}$ of calorimeter, 181,303 ft. lb.

Hence,

Total energy realized 2,416,147

Total available (*a* + *b*)..... 2,234,845

Hence,

Total efficiency..... 84·5 per cent.

Total available ..... 78·2 per cent.

Remarks.

During this test the driving power was about 6¼ horse power; the electromotive force of the field current, 6·27 volts, giving a current through the magnet wires of about 4¼ webers; and the current developed by the machine was about 40·8 webers through a total resistance of 1·866 ohms.

SECOND TEST.

Total weight calorimeter and contents..... 800·00 lb.

Hence by preceding data, heat capacity = ... 175·27 water lb.

Temperature of air..... 71·1° to 71·8°

Initial temperature of water..... 63·2°

Terminal temperature of water.... 79·9°

Gain..... 16·7°

Duration of experiment ..... 9 minutes.

Speed of main shaft, beginning... 176 per m.

Speed of main shaft, middle ..... 173 per m.

Speed of main shaft, end..... 177 per m.

Mean..... 175·33

Dynamometer reading before exp., 083

Dynamometer reading after exp.... 095

Mean dynamometer zero..... 089

Mean reading of dynamometer during the experiment (9 readings, between 643 and 669)..... 656

Electromotive force of field (by high resistance galvanometer) = $\frac{145}{168} \times 16 \times 1{\cdot}079$ =..... 14·001 volts.

E. M. F. of dynamo current = $\frac{249}{51} \times 20 \times 1{\cdot}079$ =..... 101·55 volts.

E. M. F. of terminals of dynamo; current broken, $\frac{299}{51} \times 20 \times 1{\cdot}079$ = 122·71 volts.

Energy Expended.

a. In driving armature according to dynamometer, K × 175¼ (rev.) × 9·0 (m.) × $\frac{699-656}{2}$ =..... 2,837,550 ft. lb.

b. In maintenance of field of force, $\frac{6}{3}$ × 44·23 (ft. lb.) × 9 (m.) × $\frac{(14{\cdot}001)^2}{1{\cdot}47}$ = 72,189 ft. lb.

Hence,

Total energy expended..... 2,869,739 ft. lb.

Energy Realized.

a. In calorimeter, 772 × 175·27 × 16·7° = 2,259,700 ft. lb.

b. In leading wires $\frac{1}{10}$ of above..... 7·932 ft. lb.

c. In armature $\frac{0{\cdot}14}{1{\cdot}72}$ of *a*..... 183·639 ft. lb.

Total energy realized (*a* + *b* + *c*).... 2,451,103 ft. lb.

Available (outside of machine) (*a* + *b*), 2,267,232 ft. lb.

Hence,

Total efficiency..... 84·5 per cent.

Available efficiency..... 78·2 per cent.

Remarks.

As a check we may compute the total efficiency from the galvanometer reading and the resistance: Energy developed, 44·23 (ft. lb.) × 9 (m.) × 101·55 (volts) × 1,866 (ohms) = 2,200,500 ft. lb.

The discrepancy is fairly explained by the defective insulation of long wires leading to the galvanometer, as it was raining at the time.

During the experiment the driving power was about 9¼ horse power, and the current was 87·4 webers (according to galvanometer, 54·4).

Even with this current the spark at the commutator was very trifling.

SUMMARY.

	Total Efficiency.	Available Efficiency.
According to first test....	84·5 p. c.	78·2 p. c.
According to second test..	84·5 p. c.	78·2 p. c.

The Prony dynamometer is connected to the Edison dynamometer by a belt from the same countershaft, which is also belted to the electric generators. If we should assume the correctness of the Prony, and that the loss in the transmitting power between the Edison dynamometer and the arbor of the armature was only the same as between the two dynamometers, the above numbers would have to be increased in the ratio of 100 to 93·2 (see above), and we should have:

Total efficiency..... 90·7

Available efficiency ..... 83·9

C. F. BRACKETT,
C. A. YOUNG.

Princeton, N. J., April 10, 1880.

30 July 155.

Dynamo 150 lamps 4½ turns -
for Steamboat 5

Cores .720 long
.205 Diam

Magnet; each core wound with
4½ 16 wire — 21 ohms.
total R ~~[illegible]~~ 21 ohms.

Armature Diam of core
length of core.

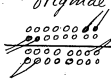
Winding 6 cores 2 turns
round

56

Aug. 15 1883

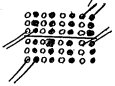
Change of Dynamo ∓ 2200 turns to slower speed

original



110 Volts
2 wires ·042 Bare
8 turns around
Ker. 2200
Commutator 24 Block.
Resist ·35. ohms

Change only in Armature



2 wires ·042 Bare
12 turns round
Commutator 24 Blocks
Resist will be ·35 + 18 = ·53 ohms.

Speed will be about 1500

Coils X speed must be equal.

8 X 24 X 2200 = 192 X 2200 = 422,400
12 X 24 X 1500 = 288 X 1500 = 432,000

288
1500
1440
288
432000

One must be turned a little smaller.

Economie de Lampes A 10 a 16 bougie

Fabrication du 7 au 13 Avril 1883.

	Résistance froid.	Résistance à 10 bougies Volts	Volts	Résist. à chaud	Ampères	Kilog. en	Lampes par cheval V.	M
1°	354	100	105	179.3	0.58	6.2	10.4	
2°	333	103	110	193.4	0.56	6.3	11.9	
3°	333	100	106	172.8	0.61	6.6	11.3	
4	325	98	104	172.7	0.60	6.3	11.9	
5	357	98	103	171.2	0.60	6.3	11.9	
				Moyenne				
			105.6	177.9	0.59	6.3	11.4	

June 3rd 1881.

List of Lamps that are now in process of making at Menlo Park N.J.

Order 285 — 10 lamps made from Regular Bamboo tops cut 6" × $\frac{8}{1000}$ × $\frac{17}{1000}$ —

at 16 candles —

June 3. 7 a.m.

33·112 minutes or 551 hr.

2 have gone

1 in 173 hours

1 in 93 hours.

Friction Metal —

Metal for Heavy weight & high speed

Tin	35
Zinc	50
Lead	10
Antimony	5
	100

Anti friction Metal

Copper	5
Zinc	85
Antimony	10
	101

62

Test of Lamps Menlo Park June 3 1881 (63)

356 Carbons 6" X $\frac{13\frac{1}{2}}{1000}$ X $\frac{8}{1000}$ –

10 lamps at 16 candle power

7 a.m. 4710 minutes 78 hours

2 gone 1 lasted 37 hours

" 1 " 64 "

Menlo Park. N.J. June 9th. 1881

Electrical Congress at Paris.

lowest price for steam power according to regulations 8¢ per H.P.

180 H.P. 5 hrs per day 100 days.

= 90'000 H.P. for 1 hour at 8¢ =

$7200

After Cabling we can contract for same at $4000. — 4½¢ per hour power per hour —

B.H.M. Boiler sent by us will cost

Boiler $3740

Expenses of Manufacturing 1400

$5140

Taking Boiler out it would be about 1½¢ per H.P. per hour —

64

Z Dynamo N° 135
Armature N° 93.
T' 1320 Volts 115.
arc 120 lamps
T. 1296 Volts 103.2
120 lamp machine Eff 2 100%.

Z Dynamo N° 133.
Armature 89.
T 1310 V. 118.
Arc 120 lamps
T' 1260 Volts 108. –

Armature resistances

		ohms		ohms
Z	60	~~[illegible]~~ ·145		1200
Z	120	·042		1300
⊥	150	·070		900
⊥	150			475
⊥	300	·037		950
K	250	·035		900
K	500			
⋿	15	·35		2200
⋿	17	·52		1650
⋿	180			

Sept 2nd 1881

Dynamo 14 lamps A

1750 turns 97.2 Volts.

5 Coils in of regulator

1728 100.5.

3 coils in regulator

1738 turns 104.4 Volts

as regulator

I find there is 5 millimeter between the armature & iron make this 2 — then wound the arres & wind on the new plan without paper except in bottom

Sept 6 1881. After alteration we get

16666 turns

111.6 Volts with all load on.

Armatures Sept 4 1885

In the armatures made with covered wires, you must have a section of wire of 0·18 mm for each lamp of ·75 of an ampere —

Armatures

Lamps	Section	Amperes
1	0·18 mm.	0·75
6	1.	4·5
1·25	0·225 mm	1

1180 110

20/24 6

614.2
1228.4

110

180

1180
25
5900
2360
29500

In the Edison machines the

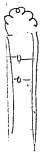
E = nombre tours ×
Diameter bobin ×
length field ×
Blocks commutator ×
turns each core × 1
strength of field ÷ 100

Strength of Z field = 1· 1071 1200 Rev–

		Volts
E –	2200 × ·119 (125) × 0·19 × 24 × 8 × 1 ÷ 100 =	95·5
Z –	1200 × ·251 × ·24 × 74 × ~~2~~ × 1 ÷ 100 =	107·
L –	900 × ·255 × ·50 × 54 × 2 × 1 ÷ 100	123
K –	900 × ·255 × ·76 × 64 × 1 × 1 ÷ 100 =	112
C –	350 × ·692 × 1·244 × 49 × 1 × 1 ÷ 100 =	147
120 –	1300 × ·251 × ·24 × 74 × 1 × 2 ÷ 100 =	116
17. –	1650 × ·120 × 0·19 × 24 × 12 × 1 × ÷ 100 =	108
180	1180 × ·230 × ·28 × 74 × 1 × 2·5/100 =	153
	× 2·/100 =	122

300 575

175 190
20 200



1000 light machine — Sept 4 1883

— No wire No 12. each coil —

— Each coil once round —

— 50 Commutator blocks

— 27 m.m. — 50 divisions —

— Diameter No 12 wire with covering 3.27 m.m

— Each coil takes wire guide 27. m.m

— Circumference 50 × ·027 = 1.350 meter

— Diameter of core 1·350 ÷ 3·14 = 0·43 m.

Average length of one coil 2·80

Field Diameter long —

— Total length wire 2·80 m. × 50 = 140 m. —

140 m. ÷ 9·64 m.m □ × ·017 = 1452 × ·017 =

= ·0247 Total Resistance

Resistance between brushes: =

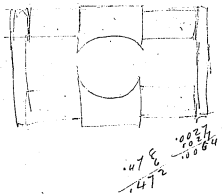
·0247 ÷ 4 = ·0061

Outside resistance ·11 ohm

inside " ·006

Ratio 1 to 19 —

See over



1000 Light machine Sept X 4 1897

What speed should this run to give 110 Volts

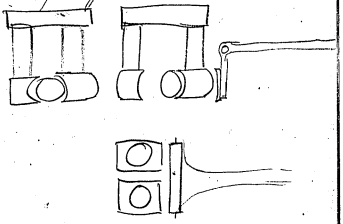
~~E~~ ~~Speed~~ = ~~Speed~~ X Diameter bobbin X length field X Commutator blocks X turns each coil X strength field ÷ 100 =

300 X .472 X .960 X 50 X 2 ÷ 10. = 135.

New ~~Length~~ Resistance bobbin $\frac{l \times \text{specific}}{\text{c.}}$ ÷ 4K .0067

Section of wire

Amperes per D.m.m section 4.1 Amp.



Sept 7th 1883.

1000 light Machine —
Pipmaking expense pr 1000 lights.
less

Meters Sept 12 1883 8 (81)

16 degres C.

Densimetre
Gay Lussac
1·06

de New York

E E Light Co of Europe Sept 12. 1883

Copy of letter Eaton to Batchelor
Aug 21 1883

Dear Sir. Enclosed please find a letter dated Aug 6 from one as pres of the Edison Electric Light Co & Mr Chas L Clarke Engineering department Edison Electric Light Company; also his reply, dated August 18 showing the cost of reproducing our present central station at Pearl St New York City. Mr Clarke's estimate has been prepared with great care in order to furnish you with a correct and reliable statement of the estimated cost of installing a new station capable of duplicating the present efficiency of the Pearl St Station

Respectfully Yours
J B Eaton
2nd Vice Pres.

Edison Electric Light Co
New York Aug 6 1883

Chas L Clarke Esq
Engineering department of the
Edison Electric Light Company

Dear Sir, Will you have the kindness

to furnish me with a written detailed & estimate of the cost of installing a duplicate of the Edison system of Central Station lighting now installed in the first district No 257 Pearl St this city including the Edison later improvements made since the Pearl Street station was installed, notably his improvement in reducing the cost of the dynamos. also in reducing the cost of conductors by means of the 3 wire system

Respectfully yours
S B Eaton
Prest.

Major S. B. Eaton
Edison Electric Light Co
65 5th Avenue
New York City

Dear Sir

Pursuant to the request contained in your letter of the 6 inst, I respectfully submit an estimate of the cost of an electric lighting

186

central Station system similar to the system at present in operation in New York city the central station of which is located at 257 Pearl St.

There is a slight variation in this estimate from the one which Mr. Chas Batchelor prepared from notes obtained while here. Mr Batchelor by accident places the inspectors at $500.00 whereas they are $130.00. The item of $500.00 for ash cans etc is omitted in his estimates. I have omitted from the estimate the amount of $750 for blower engine shafting, belting and erection as which is unnecessary as the blowers would be driven direct the capacity I have altered to 8000 lamps to conform strictly to the capacity of the dynamos. The capacity of the Central Sta. in New York is 7200 lamps of 16 candle power

Respectfully submitted

18 Aug 1883

Chas Clarke
The Edison Electric Light Co
Engineering Department

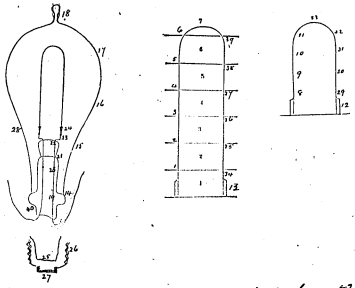
Estimate for
Central Station System E. C. Light
Capacity
8000 Lamps 16 candle power.

5 Steam dynamos with electrical outfit	56000.00
4 Babcock and Wilcock sectional boilers complete and erected	17,340.00
2 Iron smoke stacks, with foundations, supports, hoods, and fire proof cooling for same size	3338.00
Iron structure to support steam dynamos erected	3880.00
Fire proof floor	533.00
Iron stairs and platform	1250.00
Engine for boiler blower	800.00
Boiler Blower 260	260.00
Dynamo blower & engine	800.00
Blast pipe for boilers	96.00
" " steam dynamos.	273.00
Steam, Exhaust, and water pipe system complete	6061.00
Feed water heater	1200.00
Steam pumps 450	450.00

Injectors	130.00
Water meters	196.00
Coal and Ash conveyors.	2000.00
Travelling Crane	1165.00
Brought forward	95052.00
Ash Cans, Street cranes, tackle	500.00
Station, office, & mechanical outfit	1000.00
Concrete foundations	1166.00
Labor for erection not heretofore specified	4000.00
Meters.	6000.00
~~Street Conductors~~ Conductors:- laid in 3 wire system	58000.00
Total cost	166218.00

Chas L Clarke
The Edison Electric Light Co
Engineering dept.

Cause of breakage or failure Sept 12.1883 (93)



1. Broke at 5. green deposit on glass at 28 one side - looking sideways you see the copper color on it
2. Broke at 8 & 29 Carbon intact evidently never seen lighted - Broke in transit or handling
3. Broke at 3 - Platinum wire on same side a little black in sealing -
4. Broke at 1
5. Broke at 17 (hole in glass) accidental
6. Broke at 1 Platinum opposite side little black
7. " " " " both sides a little black

8 — Broke at 1. Plat. same side little black.
9 — Broke by current passing Plat + Cap.
10 — " at 1. Plat. same side little black
11 — " above 1 " " " " "
12 — " at 4
13 — Button is knocked off — (accident)
14 — Broke at 2
15 — " at 3 Plat. same side little black.
16 — " " 2 " " " " "
17 — " " 2.
18 — is knocked off (accident)
19 — Plat worn quite (too much current)
20 — " " " (" " ")
21 — Broke at 3. Plat same side little black. Indigo on the plaster showing varnishing has been done before dry.
22. Broke at 1. Plat little black same side
23 " " " " " " " " and carbon very much bent
24 Inside part exploded — I notice the glass of this inside part is to thick —
25 Broke at 2 Plat. little black same side
26. " " " " " " " "
27 " " 6 Both copper completely covered with lamp black and a little pea of same in globe —
28. is knocked off (accident)
29 — Broke at 2. Deposition glass of this is very peculiar being in four places (investigate)
30 Broke at 1 Plat same side little black.

31. Broken 1 + 34 (accident)
32 — Broke at 3.
33 — " " 1 Seat same side little black.
34 — " " 1 " " " " "
35 — " " 1 " " " " "
36 — " " 3.
37. " " 1 + 34 (accident)
38 " " 1 + 34 (")
39 Lamp perfect glass broke at 40
40 Broke at 6.
41 " " 1
42. " " 1
43 " " 1
44 " " 1
45 " " 1 and 35.
46 " " 3.
47 " " 1 + 35 + 34 (accident)
48 " " 1 Seat same side little black.
49 " " 1
50 " Broke 1. + 34 (accident)
51 Broke about 1 Seat. same side little black
52 Broke & Seat opposite side little black
53 leading wire twisted together as not enough room for plaster at X.

54 Lamp good. There was some varnish on screw —
55 Lamp good — 10 c.p. nothing made with it.
56 Broke at 1.
57 " " 3

58. Broke at 1. Flat same side. little black
59 " " 4
60 " " 3.
61 " " 1 Flat same side little black
62 " " 2
63 " " 3
64 Lump perfect Broke at 4. not enough plaster between glass + screw
65 — Broke at 4
66 — " " 6
67 — " " 6
68 — " " 1 Copper deposit all round
69 — " " 22 " " " "
70 — " " 3
71 — " " 6
72 — " " 8
73 — " " 8 + 29 (accident)
74 — " " 6 Flat black little same side
75 — " " 1 + 27
76 — " " 3 - Plaster cone - carbon deposited on both copper.
77 — " " 3 - Plaster cone -
78 — " " 22. Faint
79 — " " 3 Plaster Cone
80 " " " 1 Flat. little black on same side
81 — " " 1 + 36 (accident)
82 " " 1 Flat little black same side
83 " " 8
84 " " 3 Flat little black same side
85 " " 3 Plaster cone.
86 " " 2 Flat little black opposite side
87 } " "
88 } Only small part left + cant tell
89 }
90 }
91 }

92 — Broke at 2
93 — " " " 6 Plaster loose — Plaster green —
94 — " " leading wire Plat to wire curious
95 — " " " 2
96 " " " 2 Plat same side little black.
97 " " 2 " " " " plat loose
98 " " 1 + 34 (accident) plaster loose
99 " " 2 Plaster loose —
100 " " 1
101 " " 1 Plat same side little black
102 " " 1 + 34 plaster loose —
103 " " 1 Plat same side little black
104 (Blamp perfectly good — broke at plaster, glass twisted off when screwing up.
105 fused at 22 Plaster loose.
106 — Broke at 1 Plaster loose — Plat opposite slightly black
107 — Broke at 1 + 34 Vibration accident
108 — " " 1 Plaster loose — Badly cracked 22.
109 — " " 1 Crack on opposite Plat.
110 — " " 3 Plaster loose — both plat. black curious despair (investigate)
111 — " " 1 Plat opposite black.
112 — " " 2
113 — " " 1 Plat same side black.
114 " " 1 " opposite " "
115 " " 1
116 " " 1 " same side black, plaster loose
117 " " 6 " opposite " "
118 " " 1 Plaster loose
119 " " 6
120 " " 2
121 " " 1 plaster loose — both coppers covered with black.

122 – Bottle at 6 – plaster core –
123 " " " 3. heavy deposits very peculiar investigate
124 " " 1 flat same side black.
125 " " 1 × 34 Plaster core (Accident)
126 " " 1 Plaster core
127 – " " 2 same flat black plaster core.
128 – " " 1 " " " heavy deposit made before breaking
129 – " " 2 deposit moderate before breaking
130 – " " 11 flat black on same side
131 " " 1 " " " " " heavy deposit before breaking.
132 – 143 only small pieces left cannot tell.
144

10

1250
110

$N\Sigma = M \times L \times V$

$1 \times \frac{350 \times 2 \times 44}{2} \times \frac{1200 \times .25}{60} = 189$

$N = \frac{\Sigma}{L \times V} =$

$\frac{110}{.20 \times 9 \times 22 \times \frac{1200 \times 1.28}{60}} = .8$

Sept 12 1883 (10) (105)

Have had a new machine made

Electro-magnets 230 cm/m Iron

Keepers 520 " "

Each core wound with 47 lbs No 16 wire

		length	breadth	thick
Armature :-	Head	.650	.290	.290
	Keeper	.650	.280	.170
	Line	.080 m high		

wound like B. each bobbin 18 wires No 19. instead of 12. wires

Bore not about 2 or 3 millimetres of head

Resistance ought to be about .026

Test shows 119 Volts 111 100 lamps

118 " 109.80 " "

1242 " 122.4 100 lamps

1296 turns 129.6 100 lamps

Very much spark at 100 lamps

investigate Sept 14 1883

Sept 14th 1883 100 lights - 110 Volts "

Resistance Armature .032

Sept 12 1885

Made some lamps
4" x ·0065" x ·00925" for Vienna

They tested to day

	Volts	Resi C.	Hot	Amp.	Kgm.	Lamp C.P.
1	107·5	253	135·1	0·79	8·7	8·6
2.	106	262	139.	0·76	8·2	9·1

This cannot be right as a 5th fibre measures more -

2.
4.013 ÷ 9.8

Sept 16 1883 ✓ 109

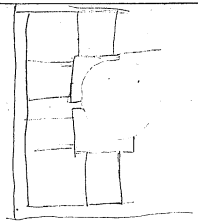
Energy lost in the field per lamp
in all old machines –

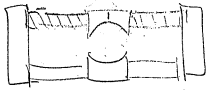
E = 7.908 Volt Ampers.
I = 5.042 " "
L = 4.03 " "
K = 3.72 " "
C = 4.43 " "

÷ 9.8 = Kilogrammeter

Nouveau model

1650 E =
126 light
300 light
600 light
Approx 1000 light





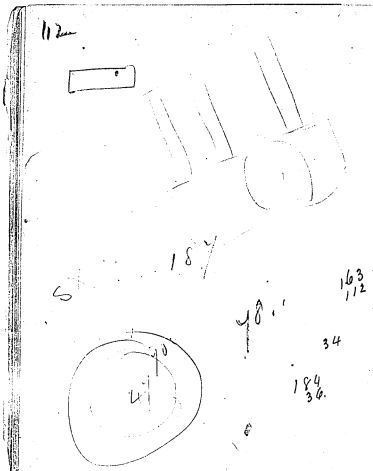
Copper on Armature per lamp.

	Total	per lamp
17 E	2·400	·141
60 Z	10·00	·166
150 L	22·00	·147
250 K	36·00	·140
1200 C	158·2	1·322
1 Lighting		
120	10·00	
300		
500		
180	15·00	

Copper on magnet per lamp.

	Total	per lamp
E	17·78	1·05
Z	61·00	1·01
old L	122·00	·813
K	186·00	·744
C	648·00	·54
1650 turn		
120 light	92	·77
300 light		
500 light	180	·36
180 "	94	·52

112



Sept 16 1883 V 13

Iron on Magnet per Lamp
" Armature per Lamp.

	Total iron Magnet	Iron per LAMP.	Total iron Armature	Total per Lamp	
E	68.	K. 4.	9.	.53	
Z	368.	6.13.	39.	.65	
L	736	4.9	183.	1.22	
K	1104	4.42	280.	1.12	
C	5224	4.35	3083.	2.57	
E 1650					
120	370	3.13			
300					
500	768	1.53			
18.0	336	1.87			

Sept 19th

Organ lighter plug
length Plat. wire 10 cent
diam. " " .004 inch
red heat
Volts 10. 6 ohms. Milliamps 1.5

machine with transmission & machine consumes 2.920 m.c per heure

depto Machine with 20 lamps in circuit 5.373.m.c per heure

after deducting 2.500 makes 143.6 litres per hour per lamp.

56 lamps on Gas 7.004 per hour 125 litres per lamp.

Sept. 18th 1883

Test with 2 cylinder gas motor

4. P.M. commenced running

Gas counter 4422.690 c m

Z machine 1157 turns

Gas machine 160 turns

56 lamps - 91 Volts - 91 amperes

at 16 candle power

Water 360 litres per hour

4.45 tous le même

Le gas sur le compteur donne 145 litres par minute

4.50 Bien

5.00 Bien

5.15 - Fini - Gas. 4433.450

Machine marchant vide consomera 100 litres chaque 2.22 minutes

---

Machine avec 20 lamps a 16 c.p. consomme 100 litres chaque 1.07 min.

Machine a consommé a peu pres ½ litre d'huile pendant le deux heures et demi

Consommation par heure

Gas. 7·004 cu pied par heure.
Water ·360 litres " "
Huile ½ litre par heure.

Rendement.
Lamps: 56 lamps 91 volts ·91 ampere

$\frac{91}{\cdot 91} = R. = 100$ ohms.

$E^2 \times 44{\cdot}13 \div R$ ~~[illegible]~~ $= 91^2 \times 44{\cdot}13 \div 1{\cdot}986 =$

Lamps + armature circuit =
$= C^2 \times R \div 9{\cdot}8 =$ Kil. =

$(91 \times 56)^2 \times (100 \div 56) \div 9{\cdot}8 =$

$50{\cdot}96 \times 1{\cdot}986 \div 9{\cdot}8 =$ 4·73 Kilopondm

Magnet
$1{\cdot}82^2 \times 50 \div 9{\cdot}8 =$

16·08
75 | 48·9·8 | 6·53 C.V.
45·0
3·98
3·75
2·30

$C = \frac{91}{1{\cdot}986 + {\cdot}44} = 47{\cdot}2$ ~~Lamps~~ Armature current

$47{\cdot}2^2 \times 1{\cdot}926 \div 9{\cdot}8 = K$

Magnet 16·08 K
Armature 31·93
Lamps. 405·93
75 | 4·53·94 | 6·0
45·0
·38

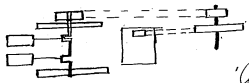
That makes as follows:—

10·760 c m gas
1·15 heures
450 litres d'eau

Travail dans les lamps
56 lamps 91 volts ·91 Ampères

Travail dans les aimants
Reid Volts

Travail dans les boite de résistance



4·73

91
56
546
455
5096

6·75 | 5·0·9·6 | 8
4·5·0
3·0·6
3·4·5
7·1

8·00
1·50
6·40

7

Sept 19th 1885 121.

180 light machine —

180 lamps.

Test 1.50 hrs armature all right but one bar commutator closed or connected to another investigate.

Speed

~~Volts~~

Amperes

Current in Amperes in field

found the trouble one of the under layers was not connected to the commutator —

Oct 5 A. 1885

Make

Cores 230 diam.

~~230~~

230 length with 30.5

Rels $\frac{145}{100}$ instead of 44 Rels

16/10 for economy of copper

+ iron

0

Sept 20th 1883

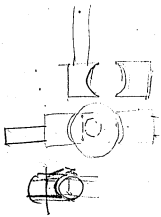
Experiment to see how many ampères you can put through the Edison tube without damage

124

1 = 100
1 = 100
2000 "
1000 "
1000 "
1000 "

6 loops
12000

+ 240
+ 4 Rue Tronchet 360



Boulevards
Place de l'Opera
round opera.
Rue Hab

Sept. 23 "1888 J

Paris Central Station (125)

Mains —

			metres
Place de la Madeleine			160
Boulevard de Madeleine	South side	⊕	260
Boulevard de Capucines	" "	⊕	500 ✓
" des Italiennes	" "	⊕	430 ✓
des Montmartre		⊗	200 ✓
" Capucines	North side	⊗	470
Madeleine	" "	⊗	220 ✓
Italiens	" "	⊕	430 ✓
Montmartre	" "	⊗	200 ✓
Connection Place de l'Opera		⊕	35 ✓
" Rue Lafitte	—	⊕	35 ✓
Rue Caumartin			460
" St Lazare		×	320 ✓
" Amsterdam		×	80 ✓
" du Havre		×	150 ✓
Place du Havre		×	100 ✓
Boulevard Haussman S.S.		+	340 ✓
" "			400

Connection to Rue Meyerbeer 80

150 + " Auber

Rue Charras.

" Magador 60 ✓

" Boudreau 100 ✓

" Scribe 170 ✓

Rond Opera 420 ✓

Place de l'Opera 120 ✓

Boulevard Haussmann to L'Opera — 70 ✓

Rue Halevy E.S. 210 ✓

" " W.S. 60 ✓

Meyerbeer W.S. 50 ✓

" E.S. 44 ✓

Chaussee d'Antin W.S. 220 ✓

" " E.S. 190 ✓

Rue Joubert 50 ✓

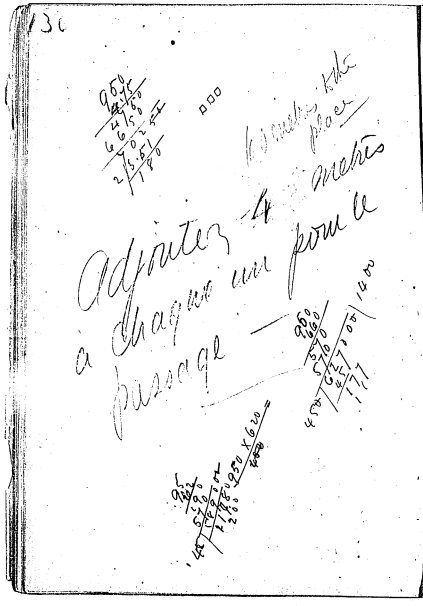
Rue du Helder 140 ✓

Rue Favart 145 ✓

Rue Gretry 90 ✓

Passage des Princes	80 meter
Louis le Grand	100 —
Rue Port Mahon	120 m.
Rue Michaudière	30 m

Rue d'amboise	50 ✓	129
Rue Marivaux	125 ✓	(p. 129)
Rue Grammont	100 ✓	
" 4 Sept.	320 ✓	
" Monsigny	150 ✓	
" Neuve St Augustin	200 ✓	
Ave de l'Opera W	320 ✓	
" " " E	310 ✓	
Rue de la paix S	320 ✓	
Place Vendome	290 ✓	
Rue Castiglione	150 ✓	
" Mont Tabor	50 ✓	
" de la Paix N	260 ✓	
" Royale E	90 ✓	
" " W	80 ✓	
Rue St Honore	410 ✓	
Rue Neuve des petits Champs	240 ✓	
Rue Neuve des Capucines	130 ✓	
Rue Volney	60 ✓	



Sept 27 1888

Lest to see what tors of volts we meur if we increase distance between the pole (p.135)

E Dynamo 2154 Rev. 109.8 V 4 lamps
2098 " 106 15 lamp

The same cores were now taken and put on a Z machine head and from this we got
1206 Rev. 61.2 volts without lamps
1190 55.8 — 60 lamps

106 volts was now sent through the magnet to be like the first experiment & we got
1160 Rev. 64.8 60 lamps
1150 " 68 4 without lamps —

now the magnet head was put so that it had the same width as the E machine 19.5 in —
Average of 10 tests now gives
— Rev. — Volts on field — Volts on mach. — lamps — amperes.
1235 106. 73.8 64.2 60. 21.8
1255 without lamps

See page 139

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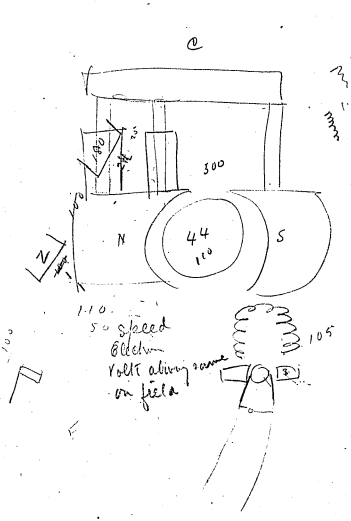
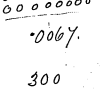
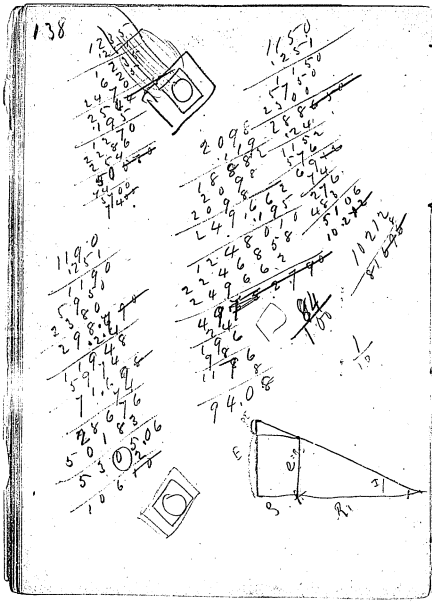


100 light Dynamo ✓ Sept 29 1887

Pirsuce Calculation + Batchelor

	Pirsuce	Batchelor
Magnet —		
Core Diam —	·280	·225
~~Length~~ —	~~·300~~	
Length —	·520	·600
Wire each core —	47K	
" Size —	16/10	
Coils —	6	
Armature		
Active Length	·960	·960
Diameter core	·525	·430
" outside wire	·545	·478
Gauge of wire	27/10	27/10
No of wires each coil	15	16
No of coils	74	50
Convolutions each coil	1	1
		
Resist Armature —	140 ohms	·0067
" Magnet —		
Speed	300	300
Volts		115



Experiment – E dynamo

E = 2098 × ·119 × ·195 × 24 × 8 × 1/100 ÷ 100 = 96 Volts

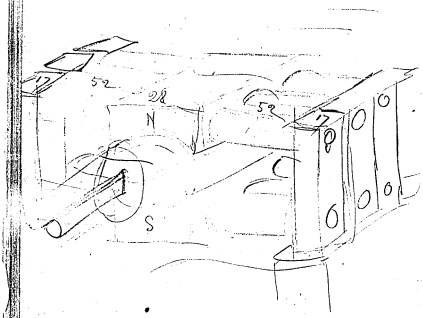
21 actually gave 106.

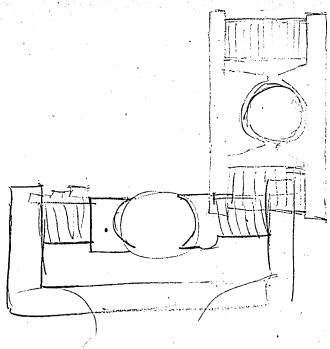
E 1190 × ·251 × ·240 × 74 × 2 × 1/100 ~~106~~ ~~53~~ 53 Volts

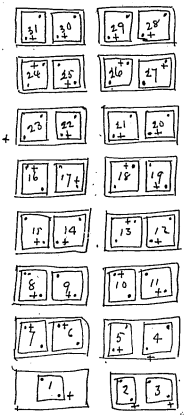
E 1150 × ·251 × ·240 × 74 × 2 × 1/100 = ~~102 Volts~~ 51 Volts

E 1235 × ·251 × ·195 × 74 × 2 × 1 ÷ 100 = 74 Volts

Add C × R formation


52
28
N
58
S





Accumulators Mouthaud — Sept 19 1883.

— 12 horse Gas motor single cylinder —
— Edison Dynamo Z for Charging —

Accumulators each contain
30 plaques lead each ·200 X ·300
giving a surface = ·200 X ·300 X 2 X 30 = 3·600 metres —
Weight of the plates alone —
Weight of the Solution —
Weight of case —
Proportion of Acid —
" " Water —

The plates are peroxidized by dipping them in a solution of hot caustic Soda ~~the plates~~ and then passing a very strong current through them,

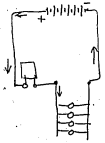
Experiment 1

Charge

time h. m	Volts	Current
10.30	$\frac{5272.4}{65} = 81.1$	$\frac{1383}{65} = 21.3$

Discharge

Lamps used	E	R.	I	$\frac{1}{R}$
1	44	28.7	1.52	0.034
2	"	28.9	1.52	.034
3	"	27.6	1.59	.036
4	"	29.5	1.49	.037
5	"	30.4	1.44	.032
6	"	31.	1.41	.032
7	"	27.3	1.61	.036
8	"	29.9	1.47	.033
9	"	29.4	1.49	.037
10		39.7	1.10	.025



Accumulators give open circuit. 66.4 Volts.

22 Accumulators give 45.7 Volts

Time	Accum.	Open Volts	Potential diff	I	Remarks
10.40	22	45.7			Lamps 1 − 7 = 7 lamps
11.23	22	45.7			Accumulators 1 − 22 = 22
11.23	22		44.5	8.9	
11.33	22		44.5	8.9	
11.43	22		44.5	8.9	
11.53	22		44.5	8.9	
12.03	22		44.5	8.9	
12.13	22		44.5	8.9	
12.23	22		44.5	8.9	
12.33	22		44.5	8.9	
12.35	22		44.5	9.8	lamp No 9 added 12.35.
12.43	22		44.5	9.8	
12.53	22		43.	9.8	
1.03	22		43.	9.8	
1.06	22	46.9			Accumulator 23 added
1.13	23		44.5	10.6	
1.23	23		44.5	10.6	
1.33	23		44.5	10.6	
1.43	23		44.5	10.6	
1.50		45.7	43.	9.8	Accumulator 24 added
1.53	24				
2.03	24		41.7	9.8	
2.08	24	45.7			
2.13	24		41.7	9.8	
2.16	25	46.9			1 acc. added.
2.23	26		41.7	9.8	1 acc. added
2.33	29		45.7	10.6	3 " "
2.41	29		41.7	9.8	"
2.44	30	49.8			
2.45	30		45.8	9.8	"
2.52	31		44.5	9.8	

T	No	V open	V closed	I	
2.55	31		42.	9.8	
3.00	31		42.	9.7	
3.14			41.7	9.8	Below 41V is not practicable for our lamps!

Experiment 2. 5 amperes for 2 hours.
31 accumulators.
Average Volts 71 Dynamo Time 120 minutes
" Amperes 5.2.
Volts of accumulators before charge 26.8
" " " after charge 67.8.

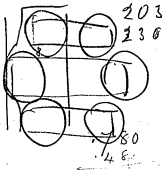
Work furnished by Dynamo =

$$T = \frac{EI}{g} \times t = \frac{71 \times 5.2}{9.8} \times (120 \times 60) = \underline{270.972 \text{ Kgs}}$$

Discharge

Time	Acc.	V	I	Remarks
				Lamps 1, 2, 4. 6, 7, 8. 9. 11. 12

15



203 X 4
230 X 8

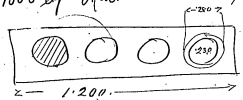
32365 64730
41548 166792
230,922

78
48

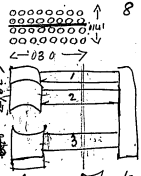
30
78

85530
256590

1000 Light Machine – Sept 30 1883 155



8 Columns each 47 Kil
on 16/15



1 = 203 X 1448 = 360 Kil
2 = 229 X 1448 = 470 Kil
3 " " 470 Kil
1300 Kil

No coils put on 2 cores of 304 X 1,100
1300 Kil
but we could only get on 3 in length in place of 4.

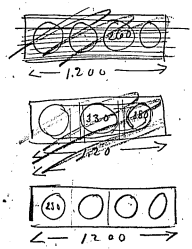
Total section of Cores of C. 1/2
~~50000~~ 231.000

Field 1200X780 = 936000

Section of 3 cores of 33 would be
256.590

1st Devis

Conductor	603.250
Chimneys	95.000
Opera int:	200.000
Building, Yard	210.000
Boilers + by.	1.398.000
	2,506,000



380 X J = ~~1200~~ 1.140
~~60~~

1.200

77

110 / 2.5 / 1.100 / 1.100 / 1.100

12½

11.400 / 6.

75 / 11.400 / 6.

11.400 / 12 / 950 / 950

Oct 1st 1884. 15

a core was now cut (p. 159)

Diam ·1163

length ·215

same weight as E ordinary

same wire wound on core as E "

and then excited with 106 volts the machine gave also 106 volts with 60 lam. ships of ·75 amperes.

when incandescent excited itself it gave 102 volts – 12 amp. – 60 lamps ·75 amp.

$24^2 = 225$

$12^0 = 1000$

$225 \div 12^0 = 177$

177 Kil. Max. = 225

39 Kil. Max. = 166

amps $0.02 = 30.50$

17.78

$102^2 \times 100 \div 42 = 1077$

$102^2 \times 100 \div 39 = 0.121$

$E \times R \div 9.5 = 102 \times$

$\frac{E}{R} = 1.0 = \frac{102}{42} = 2.43$

$\frac{110}{42} = 2.62$

$\frac{110}{90} = 1.22$

$\frac{103 \times 103 \div 9.5}{} = 1.08$

25.20

2.60

160

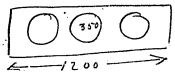
Central Station ✓ Oct 3 1889 161

We are limited to putting 2 amperes per mm through our feeders prevent heating ✓

Now when we have

section of 1 2/10 wire
mean 5·4256
5·4256
5·4256
5·4256
·1962

1000 Light machine ✓ Oct 4 163



S of magnet
28P 633

Sect-Head 480.1000

S of M = 80% Sect of Head

Armature diam -

Compared with Z + new 180

Z	S of M 21382	Sec of Head	60000 =	35
180.	S of M 41548	" "	70000 =	60

E S of M 12667 Sec of Head 23750 53

oooooooo Size of wire 2/10
oooooooo 16 turn each coil
oooooooo Mark of coil and division added =
oooooooo
oooooooo
·002 × 8 = ·002 save conductor ·028 m m.

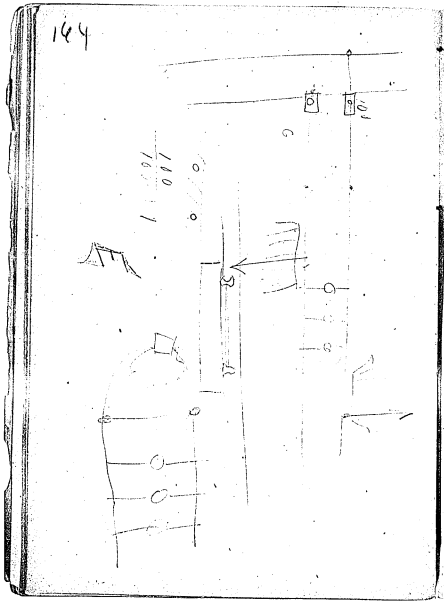
Thickness of coil ·013 m

45 coils of ·028 mm = 1·256 circum bobbin core = ·400 diameter extreme

Armature diameter extreme ·426
" " " mean ·413

$$\text{Resistance} = \frac{(1200 \times 2 + \cdot 413 \times 2 \times 45) \times 0 \cdot 017}{\text{Section } 91.61} \div 4$$

~~148·17 / 91·61 ÷ 4~~ 145·17 × ·017 / 91·61 ÷ 4 = ·0269 / 4 = ·0067 ohm.



1000 Machine

·0067 R being too much we could reduce it by winding 20 wire instead of 16 no.

$R = \frac{145 \cdot 14 \times \cdot 017}{114 \cdot 5 +} \div 4 = \cdot 0054$ ohms

How does the compare with our rule as 300 turns?

$E = Rev. \times$ Poles drain $\times$ length field $\times$ Commutator block $\times$ turn each coil $\times$ Strength field $\times \frac{1}{10} = 134$ Volts

A current flowing through a wire round wire gives a certain galvanic field, but it equal to the area X Cu the current in ampere. If we increase the iron by the field, we increase it to 32 times the strength of the galvanic field. If we reduce iron the field do not increase but the iron become less magnetic.

The length of a Magnet magnet does matter only with the action of one pole on the other. And if we use an horse shoe magnet, without any polarity in it, we may increase the height as much as we like.

	Length of Wire	No	Layers	No of Poles	Length of Magnet	Diameter
B						
Z	2193 m.	108/100	62		215	
L						
K	1665'	87/100			215	163.
Small Oil						

Speeds of new machines

25 light	1600.
50 "	1500
100 "	1400
200 "	1200
500	700 lim
1000	300.

(p. 169)

Test to be made

1 E core wound with 9 Kilos 9/00
Excite with another E 100 V.
Cut magnet in half length &
2 put the 4th Kil wire
Excite with same 100 V with
rest of wire in series
3 Reduce length again to have
same length as diameter & put
weight of wire proportional to length
Excite as before with rest of
wire in series
4 If necessary go below.
Object of this experiment is to see
if we get the same magnetism
or if less what it is proportional
to.

m 47 16/10

950

230
30
260

230
30
260
260
260
260

1475
1475
1475
1475
1475
1500

24430
4260
4260
53260

53346
4260
45346

216
4
47

300 light Machine

Armature 230 } 30 kil 14/10 —
Longer 520 }

Length of field 600.

Armature resist .018

000000 12 Wires 16/10 once round
000000
000000
000000 Commutator 54

Rev. 900

110 110 200 Amps 100/140

150 light —

Same machine

but

6 Wires 2 round

Rev. 475 —

20 | 426 | 17
142
142

300

Length		Layers	Turns	Length Magnet	Weight Copper	Weight Iron	Action
	E						
2193	Z						
	/						
	K						
	120						
	180						

Experiment

[: | :]

Diam .165
Longen .420
30 Kilos $\frac{12}{10}$ 45 ohms each

[2]

Diam .165
Longen .420
9 Kil. $\frac{85}{100}$ 45 ohms each

These were same strength

	Weight iron	Weight Cob copper		
No 1		45 K.		
2				

In this case the result.

No. 1 18 layers 6334 turns
2 13 layers 3204 turns

165
3
495

	Length	R.	Copper turns	Copper weight	Section	Iron weight	Iron wt. units	
E	2.93	22.	6½	4044	3015	21382	182	687/ton	125/145
N									
L									
K									
120	2.745		11	3981	33026	182	625	1% 16%
180	2.748		15	3435	41547	175		
C								
N	1645	45	19	2900	21382	36		27/ton	70% can all

Deductions =

1 Increase section iron ½ keeping same weight & put on same number turns of wire and your magnetism is doubled

this means:—
~~Magnetism doubled when~~
~~Weight iron same~~
~~Weight copper increased~~

2. Same weight iron
Same weight copper
Double section iron
Case of E machine
Double magnetism

3 Half length core
Half number turns
Same resistance
Reduction iron 50 %
" copper 66 %
Same magnetism

176

500 Light redesigned.

Speed 800

Pulley .450 diameter

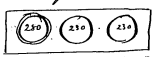
Cores 23.0 diameter out: 121 turns each layer

280 " end 2200 meter wire each core

230 length average diameter .810

Wound wt each 30.5 lbs 2707 turns ÷ 21 layers = 129

3 pairs — Pulley .450 diam.



5—250—15—250—15—250—5

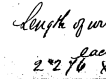
5
250
15
250
15
250
5
880

Head .880 long. deep.

e

Energy bar in magnet

270 m



21 wires - once round

16

44 ends, commutator blocks.

Diameter core .246

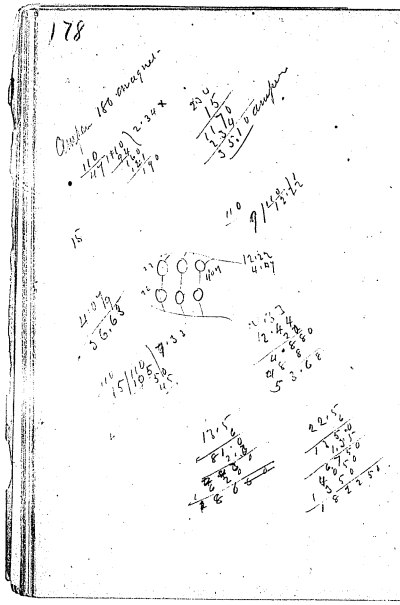
" outside .270

" mean. .258

Length of wire = .880 X 2 + .258 X 2 X 44 =

each end 2.276, total length =

2.276 X 44 = 100.144 total length



500 cycles

$$R = \frac{l \times \cdot 017}{s} \div 4 = \frac{100{\cdot}16 \times \cdot 017}{2{\cdot}01 \times 21} \div 4 =$$

$$\frac{1{\cdot}70238}{42{\cdot}21} \div 4 = \cdot 0405 \div 4 = \cdot 0101 \text{ ohm}$$

Volts = $800 \times \cdot 270 \times \cdot 880 \times 44 \times i \times 2{\cdot}5 \div 100 =$

Resistance of bottom now made 0·0106.

Resistance of new will $\frac{0{\cdot}0106 \times \cdot 88}{\cdot 75} =$

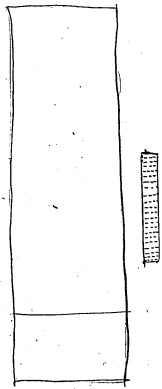
·0128

230 − 16

Bell 11·5 × 6 × 2·30 = K

205 × 6 × 1·85 = K

New Brick made of urne 18/
cost the $\frac{7}{10}$ 27 per 100 - Oct 14
Weight 107 grains
6 layers. flat urne edgeways



182

K
8.9 cent cubic
K .0089 cent cubic ds carry
per metre

190
1000

.0089
.0267
.0801

Feeders of Paris station Oct 19/88
(p.158)

1 sq m m 1 metre long = 1 cubic centimetre
and weighs .0089 Kilos

∴ Tube will carry per sq. m.m. of section

50		.223	per	mm	per	metre
100	"	.175	"	"	"	"
150	"	.165	"	"	"	"
200	"	.150	"	"	"	"
250	"	.138	"	"	"	"
300	—	.136	"	"	"	"
350	—	.133	"	"	"	"
400	—	.133				
450	—	.130				
500	—	.127				
550	—	.124				
600	—	.120				
650	—	.120				
700	—	.120				

Copper always carr .08 " " "

125
150
625
125
1875
1875

·380

·142
·114
·028

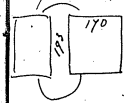
142
·056
1

114
·056

114

25 light machine

E core ·114 diameter
E section 10207.
Bobbin exterior ·128, interior 105 –
Section of head 24704



Top of head 193 X 170
Ratio of core to head 48 %

~~Area~~ 12 layers
length of core 431
Wood head ·015 each
length of winding ·380
diameter of round core ·142.

1.22 amperes in magnets.

---

for 25 light Core 1145 Diam.
Section 16513
Ratio 66 per cent

156

110
37
73

·0013 | ·3600 | 290
·0013 | ·3050 | 234

·0013

290
12
5800

≡
a × l =
1·72 × 12 = 14·64
14·64

142 × x = 43320

110 | 4000 | 1·2
42 | 9
20

142 | 43320 | 20
43320

·380
142
760
380
54020
43320

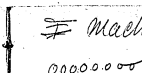
·128
·4020
3220
·1608
·1608
·15997

3
36
·09

2808 × 380 × 114 =
2808
14990
22464
22464
1359920

234 turns × 12 =
2808 turns at ·056 each strength =
2808 × ·056 × 314 =

≡ Machine Oct 22 1880 18/



altering to 25 light requires instead of

	17	25
Instead of 2 Wires 12 times round 3 Wires 8 times round		
This will give at 1650 of 3 Volts		
Core Diam	·114	142
Sec	10207	15836
Head Sec	24704	24704
Wire —	18/10	18/10
layers	12	12
Diam outside	·142	
Diam. average	·128	156
Core length	431	·335
Core length wound	·380	·305
length wire each core	1399m	1375
Current in wire Amp.	1·22	1·22
Current × layers = Amp.	14·64	14·64
length × a = length of core		

To be worked by Turbine.

To give 109 Volts at 1650 turns + 25 A lamps

188

Am ·044
Mag 45
200 Lamps.

Energy.

Lamps 100 X ·714 X 200 — 14280 -
Cond 10 X ·714 X 200 — 14.28
Mag. 110 X $\frac{110}{45}$ = 244 X 110 — 268.40
Rst. I_B =

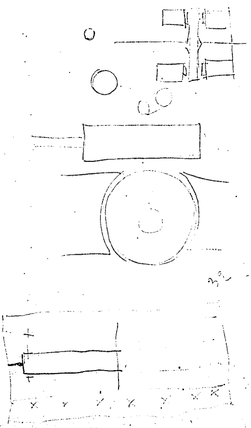
714 200 ... 500 / 3600 / 0·72
3500
1000

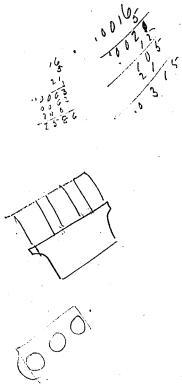
100 / 850 / 0·83 200 / 1650 / 0·825
1600
500
400
100

50 / 210 / 0·7
200

1000 Light ~~Central Station~~ Machine — Oct 27 1883 — 189

Core ·350 Diameter
length





Comparison of 180 light machine and new 1000 " " Oct 1883

		180	1000
Bobbin	Length of iron	275	
	Diam. of iron	240	400
	Diam. of outside	260	426
Winding	18 Wires – 19 BWG – once bound (9/10)		
	Average diameter	253	
Head.	Length	280	1200
	Height	280	426
Core	Diam	230	350
	Length	520	
	Section	41547	288633
Wire	No.	16/10	
	Weight	47 Kg	
	Layers	15	
	Resistance	2.315	
	Amperes	2.34	
Commutator	Blocks	74	45
	Coils	74	45
Wire on Magnets	Length	2748.	
Head	Section	78400	51120
	Ratio of Section of Core + Head	53%	56%
Armature resistance		.03	.0054
	Ratio of length of bobbin	1	4.25

50

Armature ~~.04~~ 0.18

Inducnel 90.

Energy Lamps =

100 × .714 × 50 = 3570 Ka.

cond 10 × .714 × 50 = 357

mag. 100 × $\frac{110}{90}$ = 134.70

Ribbon. 1 = 3570 + 122 = 3692.

E = 3692 × .18 = V 6.64

Cu 6.64 × 36.92 = 245.15

4303

4303 / 245500 | 0.05.69
21515
29850
25878
40320
38.7

4303 / 13400 | 0.031
12909
4910
4303
6070

4303 / 3 2270 | 0.01.2
3 4424
3 8727
5430
4303
1127
8606

	150	1000
16 Wires of 2.4/10 each coil one round.		000000000 000000000 000000000 000000000

194

140
1020
510
282
700
75

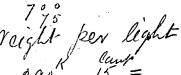
75 282

140 / .25 | 140 / 120 = 5.6
180

Weight per light —

E - 290 lb Lamp 15 = 19.3 per lamp.
25 - 281 25 = 11.3

25 90 100 .140



~~Eve lamp. 100 / x 25 x .714 = 1785~~

Cond. 10 x 25 x .714 = 178.50

Mag 110 x 110/90 = 122 — 134.20

Pellon = .7628 x 19.07 = 145.46

Current I = $I_L + I_m$ = 17.85 + 1.22 — 19.07 — 2243.16

Volts = I_D x .04 = 19.07 x .04 = .7628

Eff

2112.24 / 14.5400 | 0.0068
1 6 7 3 4
1 8 6 6 5 6 0

Efficiency — 155

180 light

Energy Armature	3.4 %
" Magnets	1.73
Circ. ext	94.87
	100.00

25 light

Armature	0.0684
Magnets	.106
Circuit ext	87.6
	100.00

50 light

Armature	5.69 %
Magnets	3.10 %
Circ Ext	91.21
	100.

200 light

14 Nov. 1883

From Page 184

Jan 1884

Unit of Magnetic field — that strength of field that will give 1 Volt in one Metre of wire cutting it at 1 metre per second in speed —

$E = M \times L \times V$

Rob L machine

1200 Rev. $M = E \times L \times V =$

$110 \times \frac{\cdot 240 \times 4 \times \cdot 44}{2} \times \frac{1200 \times \cdot 250}{60} =$

$110 \times (240 \times \cdot 44) \times 20 \times \cdot 250 =$

$110 \times 17 \cdot 760 \times 5 = 9768$

$100 = 5 \times 2 \times \cdot 10$
D A B C

$D = A \times B \times C$

$A = \frac{E}{B \times C} = \frac{100}{2 \times 10} = \frac{100}{20} = 5$

M = unit magnetism

E = total length of wire which cut = length of field × 2 × Commutator Block ÷ 2 if multiple arced

V = velocity of cutting speed & means Rev. × Diameter ÷ 60 seconds.

M. of 200 light machine = 1

$E = M \times L \times V =$

$1 \times \frac{\cdot 280 \times \cdot 44 \times 2}{2} \times \frac{1200 \times \cdot 265}{60} =$

$1 \times 20 \cdot 720 \times 5 \cdot 3 = 109 \cdot 81$

$\therefore M = \frac{E}{L \times V} =$

$\frac{109 \cdot 81}{20 \cdot 72 \times 5 \cdot 3} = \frac{109 \cdot 81}{109 \cdot 81} = 1$

20·72
5·3
6216
10360
109·816

L. Machine

$M = \frac{E}{L \times V} =$

$\frac{110}{\left(\frac{\cdot 240 \times 4 \times \cdot 44}{2}\right) \times \frac{1200 \times \cdot 250}{60}} =$

$\frac{110}{\cancel{17 \cdot 76} \times 5} = \frac{110}{17 \cdot 15} = \cdot 62$

36·66

Jan 10 1894

Magnetic field.

Strength of

K machine

$M = \frac{E}{L \times V} =$

~~112 ÷ (.255 × 2 × .641) ×~~

~~(1200 × .255) / 60 =~~

~~112 ÷ (16.32 × 5.1) =~~

~~.76 × 64 = 304; 456; 48.64~~

~~112 / 33.23~~

~~48.64 × 5.00 = 243.20; 243.20 × .255 = 5.100~~

$112 \div \left(\frac{.76 \times 1 \times 64}{2} \times \frac{1200 \times .255}{60} \right)$

$112 \div (48.64 \times 5.1) =$

248 | 1120 | 0.45; 992; 1280

$\frac{112}{248} = .45$

~~Strength of K~~

~~.255 × 20 = 5.100~~

~~.76 × 64 = 304; 456; 48.64~~

~~48.64 × .71 = 48.64; 4320; 243.20; 248.064~~

~~1.75 × .255 = 8.75; 60; 12~~

~~8.75 × .255 = 8750; 4375; 12 | 44625; 3.72~~

25 light

M

$110 \div (.76 \times 64 \times 5.1) = \frac{110}{248}$

248 | 1100 | 0.45; 992; 1080

$110 \div (48.64 \times 3.72) = \frac{110}{181} =$

48.64 × 3.72 = 97.28; 3406.48; 145.92; 180.9408

181 | 1100 | 0.60; 1086; 140

200 L machine

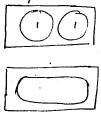
41547

78400

74200 | 415470 | 1.58; 371000; 44470

Jan 17 1884

Lest see what gain can be made on a 300. light machine by making instead of two coils each side one long



41.44 | 110.00 (2.65)
8288
2910
2486 64
2256 0

.246

200 light machine

	Core	Coeln	head	
		41547	74200	56 %
1000	"		646600	

41.44
4.92
8288
2976
3.5 3.6
20 3.8 8 4.8

.246
60 | 1200 (4.92)
240
5200
540
540
20

$$\frac{110}{\frac{280 \times 2 \times 74}{2} \times \frac{1200 \times .246}{60}} = \frac{110}{203 \quad 101.5}$$

.246
560
246
2760
2720
41.440

$$\frac{110}{41.440 \times 4.92} =$$

101.5 | 110.0 (1.08)
101.5
8500
8000

$$\frac{110}{280 \times 2 \times 74} \times \frac{1200 \times .246}{60}$$

2.65 × 4.92

·246 × ·2220 = 19·6920 = ·0546 = 4·8976 = 54·5512 = 10 2·1024 0

·246 × ·152 = ·0492 = 3·0720 = 3·9120 = 0·4 = 4·10 | 1·220 | 0·245 = 20·20 = 12·12 = 36·00 = 72 ...

4·775 × 4·095 = 19·6 × ·102 = 1·96 × 2 = 20·6 = ·120

60 | 1·55 | 0·0064 = 500 = 1·5

4·775 × ·387 5

100 light machine = (p. 205)

Take 1350 turns – 60 blocks. 152 diameter. 249 length. 2 turns round. } armature.

Sec. of exc. to head { 50 light 45%; 200 " 56%; 100 " }

Take 14/10 wire for armature. See 1·884

9 ÷ 1·54 = about 6

then 6 wire of 14/10 twice round

Circumference = 152 × 3·14 = ~~4·77 m~~

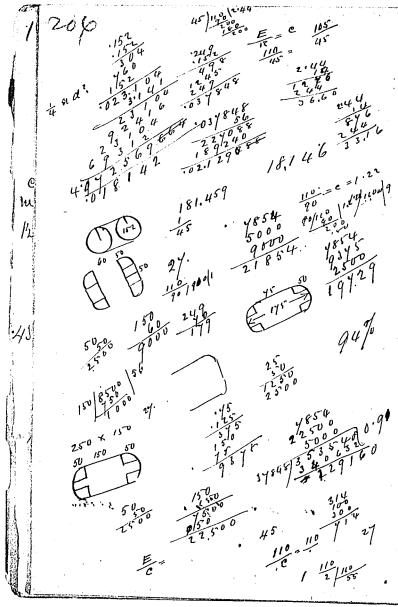
~~60 turns ·003 = ·180 for fibre~~

60 turns ·0015 = ·09900

~~4·775 – ·180 = 4·595 about~~

4·775 – ·090 = ·388

·0064 for each.



100 light machine

Conductors to fill	1350 turns
Diameter bobbin now ~~152~~	148
Length " " ~~249~~	250
Coils twice round	

To have same magnetism as 200 light machine we must have section of core = 56% of the section of head.

Section of head = ·249 × ·152 = ·037848

Then on core must be ·021295

By making core 250 × 150 with corners of 50 mm radius we have a section of

35.354

$\frac{35354}{37848}$ = about 91%.

Current round the magnet of 200 = $\frac{110}{45} \times 16$ = ~~30.150~~ 33.16 Ampères

Perimeter 314 + 50 + 50 + 150 + 150 = 714 mm

We will send 27 ampères round using 12/10 wire

12/10 Section 1·13
Diamete ·0012
Diamete enlarge ·0016

2 ampères of current + 16 Volts = $\frac{110}{2}$ = 55 ohm

$$\frac{E}{L \times d} = 110 \div$$

$$\frac{\cdot 24 \times 4 \times 74}{2} \times \frac{1200 \times \cdot 251}{60} =$$

$$\frac{110}{14.76 \times 5.02} = \frac{110}{89.445}$$

35.52

178.31

$\cdot 240$
$\cdot 251$
240
1200
480
4 0 2 4 0

2 1 3 8 2 0 | 0.35½
1 8 0 4 2 0 0 0
3 3 7 1 2 0 0

4 5 | 2.44
90
200
180
200

2.44
2.44
9 7 6
2 4 4
3 4.1 6

4² | 1 0 4 | 2.4²
2 4 0 0
2 4 0 0

2 6² | 3 4
1 8.

Suppose we take 90 turns of 12/10

then

$$\text{length} = \frac{90 \times 1.13}{.017} = \frac{101.70}{.017} =$$

6000 inches

3000 each one

1/8 turn

Circumference 250 × 148.

148 · 148 × 3.14 · 465 circ –

6 turns three round 14/10

14/10 = 8. = 1.54 ▣ mm

9.24 ▣ section for

100 lamps ÷ 18.58 = 100/18.54 =

5.3 amperes per sq. mm.

64 blocks each 465/64 7.3 mm

wire 1.4 } × 3 = 5.04

covers .4 } 1.9 for division

7.3

Suppose we have 60 ohms in Magnet we lose what per cent?

200 light we lose in Magnet. What

200 lamps	100 x .714 =	14.280 Volt amp.
Line	10 x 143 =	1.428
Magnet =	110 x 2.44	2.68
Armatur		0.18 Volt amp.
		~~1.419~~
		16.804

Lamps	84.4 %
Line	08.67 %
Magnet	.01 6 %
Armatur	0 5 6 %
	100

100 lamp machine

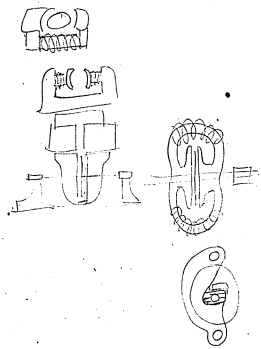
214

1	975
2	2100
3	300
4	320
5	500
6	550
7	750
8	1300
9	1500
10	12900
	18395
	1839

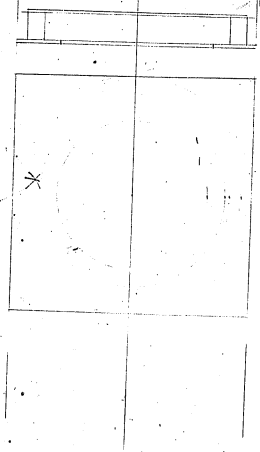
Change of Magnetic Mch 1894 211 (p.215)

500 Watt mach.

2 5/8 area 5·4

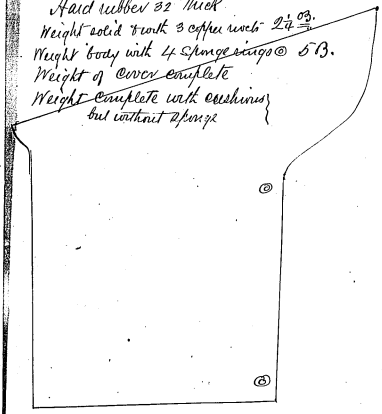


#6 Murphy – Details of Sponge holder Jan 6 1899



#6 Muzzle:- Jan 6 1899

Hard rubber $\frac{1}{32}$" thick
Weight solid trunk 3 copper rivets 2 7/8 oz.
Weight body with 4 sponge strips ⊚ 5 oz.
Weight of cover complete
Weight complete with cushions
but without sponge



.28

Muzzle

Jan 17 1899

Make the air come in through a reservoir of water or glycerine

Muzzle 8

Jan 17 1899

Bandage cloth dipped in Silicate of Soda + dried then lapped many times round open part and held by rubber rings.

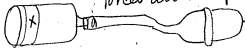
S.Z.

S.Z.

Apparatus for testing Muzzles Jan 22. 1899

Take a canister of tin

+ Cut holes out of it say 2" long + 1" wide all round the circumference close to one end solder a tube in cover + to this fix an air bulb of rubber so:- When squeezed it forces air out of can through



X + when released it draws air in again

284

			5%
Charge	5A	2.74.	44 Volt.
Discharge	10A	21 mm	9 lamps 16 c.p.
Charge	5 A	4 H	44
Discharge	10 I	1.10	8 lamps 16 c.p.
			38 %
Charge	5 I	6 H.	
Discharg	10	1.45	8 lamps 16 c.p.
			31 %

Charles Batchelor Notebook, Cat. 1301

This notebook covers the period September 1880-January 1882. All of the entries are by John W. Howell. The book contains notes, drawings, and graphs of electric lamp experiments, which are numbered 1 through 604. The spine is labeled "Expt 1-603." The cover is marked "1." There are approximately 140 unnumbered pages.

No. 1

Sept 30th 1880

Order from Hardison
Lamps for X.X. Columbia
250 Lamps carbons
0"012 X 0"010 X 6"

No. 00 X 7" 75
wide wooden bases with felt Stamp.

Shipped

No 2

100 Lamps
Carbons 0"017 X 0"012 X 6"
Mount in Sockets X.X. Col. Style
The above orders to be made after big test & when convinced
J.A.E.

Shipped

No 3

Dec 28 1880

Send 6 - 1/2 size Lamps to
Prof J. K. Macomber State
Agricultural College
Ames Iowa

Filled

No. 4

Jan 6th 1881

12 Lamps A. Size

No. 5

No 1 1 Milligrame Naphthaline
Crystal put in Globe

No 6

No 2 5 Milligrame Naphthaline
Crystal dissolved in Gasoline 1/2
Thimblefull then wash globe, get
some of carbon that Lamp before
Gasoline put in. After Gasoline put
in and shaked around let it
run out and then put on pump
Exhaust in reg. way

1 Lamp 341 minutes arc'd
48 minutes

No 7

Put in globe, one phos-
phorous acid size of bird
Shot

No. 8 — No. 4 – Put Sodium size of Bird shot.

No. 9 — No. 5 – 3 Milligrams Crystal Chl. Carbon
1 Lamp 315 Minutes 48 C.P.

No. 10 — No. 6 – Mellar heavily the platina wire & Clamps.

No. 11 — No. 7 – 2 Milligrams Benzoic Acid

No. 12 — No. 8 Wash globe before putting in pump with sulphuric acid let it drip out all that will then Exhaust.

No. 13 — No. 8 Cut a piece of Charcoal 3/16 sq. Soak in melted (by heat) Napthaline crystals then put in Globe and Exhaust in reg. way.

No. 14 — No. 9 Heat a piece of Charcoal 3/16" sq. & while almost red plunge under Mercury. Have a bottle ready 1/2 filled with strong Aqua Ammonia take the Charcoal out of mercury and plunge quickly in bottle but not touch the liquid and let it absorb ammonia gas for 5 minutes then put in Lamp and Exhaust.
1 Lamp 934 Minutes 48 C. Ind

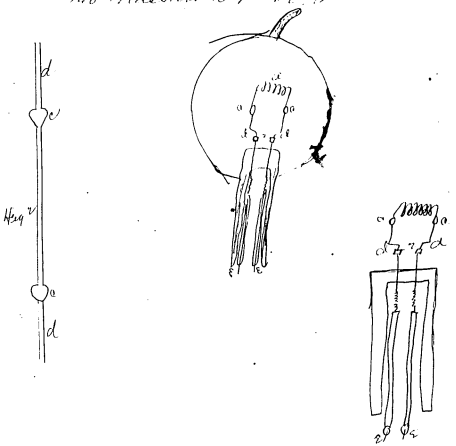
No. 15 — No. 10 – Clean the Globe with Wood Naptha (Pyroxilic Spirits) then Exhaust

No. 16 — No. 11 – Put in piece 10 Milligrams pure Benzoic

No. 17. No 17 Soak an already carbonized horse shoe in shellac that is about as thin as that used for varnish, then allow it to drip & dry well. Then put it in a heat with the regulars and see if it comes out shining, the same as the rest —

June 5th 1881

No 18 6 Lamps to work made as per P.O. drawing, brass. for R.W. Burrell
No Nassau St N.Y.



Jan 8 81

No 19 25 Lamps 3 in & 3½ thousands

No 20 Carbonize 10 Carbons with as light a weight as possible
Wild.

Jan 10 81

No 21 5 Regulars plated on Clamps & wires by deposit of Copper extra thick the Copper plating to be painted with an ether solution of bichloride of Carbon saturated solution then put in Globe and exhaust.
2 Lamps average 1050 minutes 4 & 8 candles

No 22 5 Regulars same as order 21 except the painting is done on the flat part of the inside part of the glass when the wires have been through.
2 Lamps average 740 minutes 4 & 8 candles

No 23 Regulars same as before except that the Carbons after plating as before are sealed in the globe ready for the pump are to be dipped for 2 or 3 seconds in an ~~other~~ solution of bichloride carbon then immediately sealed in globe —

1 Lamp 905 minutes
48 Candles

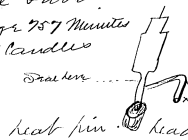
No 24 Regulars same as previous except piece charcoal ⅛ sq. is heated gently over flame, then thrown into melted bichloride carbon this piece of charcoal so calcinated with chloride carbon in solid state is to be put in lamp bulb care being taken when sealing in carbon coop that heat doesn't strike this piece or put it in after.

2 Lamps average 448 minutes
48 Candles

Jan 13 — 81

No 25 Regulars same as before with a pin head of Tri chloride carbon in side tube.

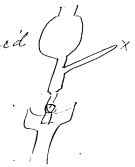
2 Lamps — average 757 minutes
48 Candles



When examining good heat pin head of carbon with spirit lamp gently & totally go the Tri chloride carbon be careful that if it doesn't boil up so it will go into the lamp globe and boil until Tri chlo. all disappears be sure and not use more than pin head of crystal

No 26 Regulars same as before arranged thus a piece of Tri chloride of carbon being put in X but the lamp is exhausted & heated in regular way without heating the Tri chloride, observe heating the lamp is finished & after it is cool by the heat the Tri chlo. is vaporatory.

1 Lamp 240 minutes and
48 Candles

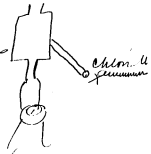


No 27 8 Regular Copper plated on wire put in Globe then heated in oven just as you do for regular but instead filling them with pumps allow them to cool and then pour in globe 1/2 a thimble full of the Coating about 2 pin heads Bichloride resolved in it. Do not allow the solution to touch the carbon loop. After you have worked the solution all around then pour out & put on pump & exhaust in regular way

2 Lamps average 816 minutes 48 Candles

No 28 8 Regular copper plated to wire & 2 pin heads of solid Chloride ammonium in tube & tries

2 Lamps average 840 minutes 48 Candles



When ammonium chloride keep lamp burning & heat chloride amount. Over hot will mistreat it

No 29 2 Lamps with regular plated to wire by copper and before sealing the whole loop is to be immersed in a Saturated Solution of Protochloride of mercury then dried and sealed in globe & exhausted in regular way.

1 Lamp 700 minutes, 48 Candles

No. 30 2 Lamps regular plated to wire in each globe a cube of charcoal Saturated with chloride of Bromine is placed while exhausted in reg. way

2 Lamps average 1232 minutes 48 Candles

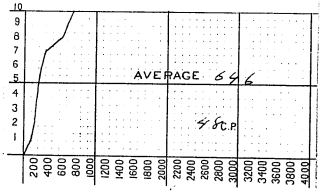
No. 31 2 Lamps regular plated to wire & before the carbon to be clipped for 10 or 15 seconds in Saturated Solution of Chl. Lead in hot water. Afterwards dry loop in oven & then seal in & exhaust in regular way

2 Lamps average 1180 minutes 48 Candles

No. 32 — Jan 13 - 1881

Starts 12 filtros mkd a.a.
2nd Bundle
Discription Full of sap if Orasoned would be like our No 5 Stock,

32



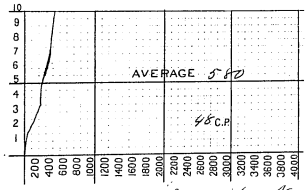
No 33 — Bamboo O.T.C.
No Life Test

No 34 — Same as above

No 35 — Jan 13 - 81

Filtros mkd D.D. 2nd Lot
~~Very fine filtro~~ Not very good
Carry air Pores & filtro seams out
Air not as good as D. or 33
To bark
Air Dumpfe 11/2 in Behrum Tonuts
1 1/2 mm Diam Malaka 5 years
Did Orasoned 40 to 60 years 10 ft Pole

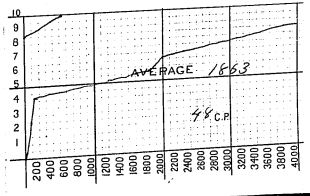
35



No 36 — Bamboo order No Life test

No 37 — Filtros Mkd G.G. 2nd Lot
Very fine Small filtro seams but Pores
Exhaud to bark, better than D.D. but not
as good as 2 or 33.

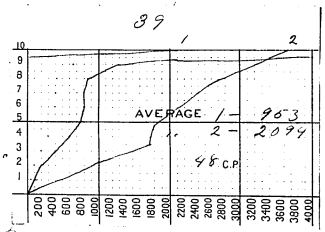
37



No 38 Bamboo roller
No Life Test

No 39 Fibres Mk'd R 2nd Sort
very nice fine fibres but not ~~very~~ enough in from the bark to get fibres 8/100 out the pores are big and pith & rays are wide almost to edge

39



No 40 Bamboo roller
No Life Test

41 Same as above

42 " " "

No 43 Fibres Mk'd L 1st Sort
The fibres are very close together
The pith & pores are very small
Came too small to work
1 Lamp 880 minutes and 48 Candles

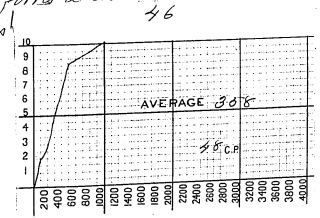
No 44 Bamboo no Life Test

45 Fibres Mk'd Q 1st Sort
This is a very good quality of
Bamboo The fibres are small &
close together & so are the pith
& rays & pores. The color is
Brown. White. Dark & large yellow spots
on surface. Madaka seasoned
about 50 years —
1 Lamp 1890 minutes 48 Candles

No 46 Fibres Mk'd A 1st Sort
Somewhat the same as our No 5
Stock The fibres a little smaller

46

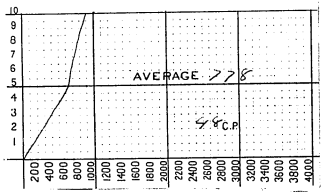
Madaka 4 years
old seasoned



No Fibres Mk'd E, 1st " Lot

47 Same as our No. 5 Block of Bamboo

47



No 48 Bamboo drawn. No Life Test

49 Take "regular" with x tube on and put in tube a few Crystals of Fer Chloride of Carbon & also of Naphthaline make two of these and when vacuum attained, heat the Crystals & volatilization which Carbon is burning

2 Lamps average 371 minutes 48 Candles

No Things to be put in the Auxilliary

50 Bromide Potassium
1 Lamp 130 minutes 48 C—

51 Bromide Sodium
1 Lamp 8 vs minutes 48 C—

52 Chloride Nickel
no Life Test

53 Cadmium
1 Lamp 650 minutes 48 C—

54 Chloride Aluminum
no Life Test

55 Chloride Sodium
no Life Test

56 Chloride Uranium
no Life Test

57 Double Chloride Potassium and Chromium

58 Chloride Magnesia
1 Lamp 45 minutes
15 Candles

No. 59 Bromide Magnesia
no Life Fast

60 Sesquichloride Chromium
1 Lamp 100 minutes
48 Candles

61 Bichloride Tin
no Life Fast

62 Chloride of Zinc
no Life Fast

63 Chloride Barium
1 Lamp 60 minutes
48 Candles

64 Chloride Cadmium
no Life Fast

65 Chloride Calcium
1 Lamp 100 minutes
48 Candles

66 Bal Ammonia
1 Lamp 1880 minutes
48 Candles

No 67 Bi Chloride Mercury
1 Lamp 940 minutes
48 Candles.

68 Chloride Lithium
1 Lamp 775 minutes
48 Candles

69 Chloride Manganese

70 Sesqui Chloride Iron
1 Lamp 385 minutes
48 C

71 Chloride Lead
1 Lamp 810 minutes
48 C—

72 Chloride Silver
1 Lamp 10 minutes acid
48 — C—

73 Dry Caustic potash made
very dry
1 Lamp 210 minutes 48 C—

74 Bichloride Mercury
1 Lamp 935 minutes
48 — C—

75 Benzoin Gum
1 Lamp 230 minutes
48 — C

Number

76 Camphor
1 Lamp 3535 minutes 48 c

77 Carbazolic Acid
1 Lamp 1205 minutes 48 c

78 Carbolic Acid

79 Selenium
1 Lamp 745 minutes 48 c

80 Tellurium
1 Lamp 540 minutes 48 c

81 Thyme

82 Tri Chloride Carbon

83 Broate of ammonia

84 Bromide of Ammonia
1 Lamp 490 minutes 48 c

85 Iodate of Ammonia

86 Bichloride of Platinum

87 Chloride of arsenic

No
88 Bromide of arsenic

89 Chloride of Ammonia

90 Tri Chloride of Bismuth

91 Tri Chloride of Antimony

92 Penta Chloride of Antimony

93 Jan 13th 1881.
Ammonium and Slaked Lime.

94 Chloride of Strontium

95 Chloride of Cerium

96 Chloride of Cobalt

97 Chloride of copper

98 Chlorinated Lime

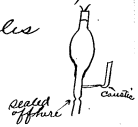
99 Penta chloride phosphorus

100 Peroxide of Lead.

101 Carbonate Ammonia

102 3 Lamps with very dry caustic Soda and heat Lamps previously to get out moisture

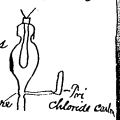
103 3 Lamps ditto caustic potash K.O. to be heated previous to heating lamps
1 Lamp 505 minutes
48 Candles



No. C.B. Jan 14 th

104 Make 2 Lamps with neck so:-
and contraction for sealing off below
so as to leave neck on when sealed off.
Bring up usual manner, and heat
the Trichloride of carbon in extra tube
to volatiligation complete.

2 Lamps - average 1685 minutes
48 Candles



105 Jan 14 th 1881.
Bamboo order
No life test.

106 Jan 15 th 1881
Three (3) Regular lamps with 3
tubes so: Put Phosphoric anhydride in
No. 1. put Fused caustic potash in No 2
put sulpher in No. 3.
Manipulate the carbon in the regular
way: dont heat 1.2.or 3.

2 Lamps - average 325 minutes
48 Candles

107 Bamboo Order
No life test.

No. Jan 16 th 1881.

108 2 Lamps "regular A" carbons but
the carbons coated with alumina.
No life test.

109 2 Lamps "regular A" carbons but
the carbons coated with chloride of
Barium. No. life test

110 2 Lamps "regular A" carbons but
the carbons coated with magnesia-
No life test.

111 2 Lamps "regular A" Carbons but
the carbons coated with Strontia.
No life test.

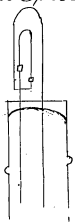
112 2 Lamps "regular A" Carbons but
the carbons coated with Selica.
No life test.

113 2 Lamps "regular A" Carbons but
the carbons coated with Lirconia

114 2 Lamps "regular A" carbons but
the carbons coated with Cerium Oxide.

115 Bamboo order
No life test.

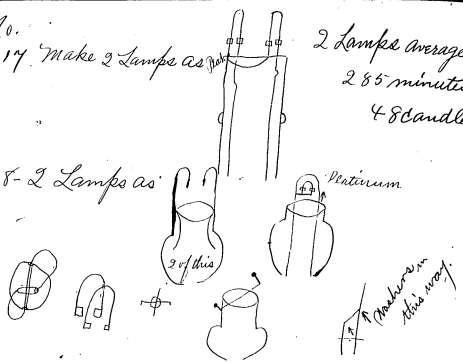
116 One lamp as
Platinum



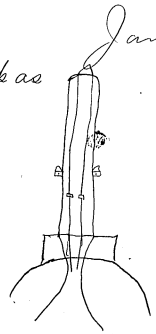
No.
117 Make 2 Lamps as

2 Lamps average
285 minutes
48 candle.

118 - 2 Lamps as



#119 Jan 17, th
One Lamp as



No
120 Bamboo Order
No life test.

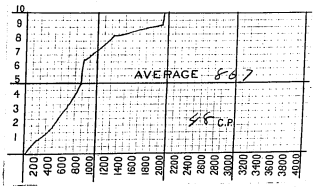
121 Put 25 regular carbons A size &
all below 300 Ohms cold in
Platinum clamps.

122 Jan 19th 1881.
Make two pumps with tubes on for
heating fused caustic potash in
place of the phosphoric anhydride -
take off 3 Lamps from each and be-
fore heating the carbons heat up the
caustic potash to take out the
gases from the carbon.

123 Bamboo Order Jan. 19th 1883.
No life test.

124 One lamp marked R.R. Bark off

124



No. 125 Bamboo Order.
No life test

126 Jan 20th 1881.
One Lamp marked E. Bark left on.
1 Lamp 315 minutes circd.
48 candles.

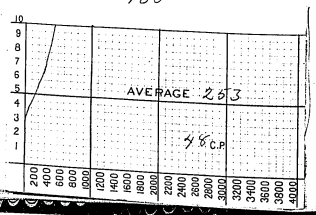
127 Bamboo Order
No life test.

128 Bamboo Order.
No life test.

129 Make 6 inside parts with copper wire only. If successful embody in regular Lamps but mark distinctively

130 Lawson - Plate the ends of carbons that have been extremely high on pumps and are sprung between the clamps holding these carbons on a previous test having the carbons intact. The plating on one clamp was removed by the.

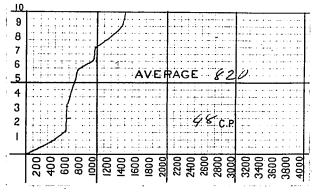
130



No 131 Bamboo Order
No life test.

132 25 Lamps regulars A size; that the fibres in Carbonizing have had to pull the smallest possible weight - If possible no weight at all.

132



133 Bamboo order
No life test.

134 3 Lamps A. size very short
3 " B "

135 Lamps with P. + clamps and plated carbons

136 Lamps with P + clamps and unplated carbons.

137 Bamboo Order, No life test

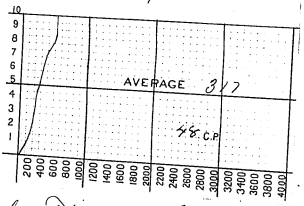
138 Make Fibres mkd a. a. x with bark left off.
2 Lamps average 470 minutes
48 candles

No Jan 25 th 1881.

139 Bamboo order, no life test.

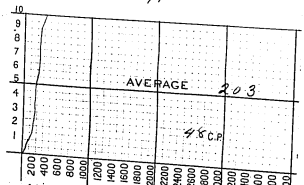
140 Make Fibres mkd 26 with Bark off.

140



141 Make Fibres mkd 27 Bark left off.

141



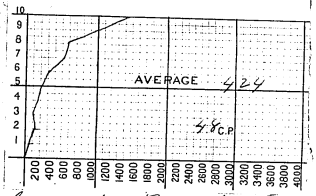
142 Bamboo Order, No life test.

143 Bamboo Order No life test.

No.

144 Fibres mkd 28 Bark left off.

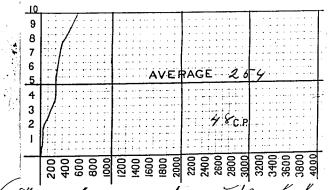
144



145 Bamboo order, No life test.

146 Make Fibres mkd 29 Bark left off

146

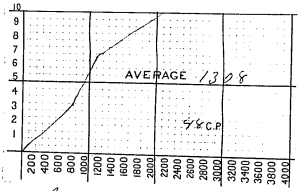


147 Bamboo order, No life test

148 " " " " "

149 " " " " "

No 150 Fibres Mkd. E.E. Burk on 150



151 Bamboo order No life test

152 Make ten inside parts with bubbles around wires. seal in small bulbs without lamps and exhaust for spark guage.

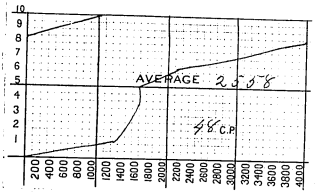
153 Carbons from new Furnace.

154 Carbons 10 X 17 New Furnace not plated platinum clamps.

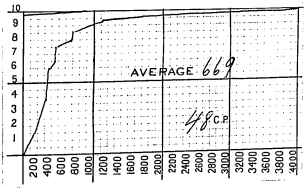
155 Change carbon from lamps with order no. 130 on it

No. 156 A size fibres with to draw B size weighted in new furnace.

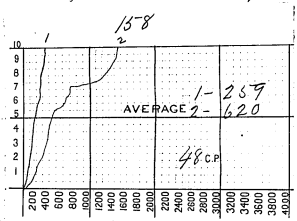
156



157 10 X 17 A size fibres to draw up the B weights in new furnace put in Platinum clamps not plated.



No 158 Carbons plated on clamps



159 Regular carbons made in spiral

160 Bamboo Order No life test.

161 Carbons when from moulds 300 - 350 ohms cold.

162 Carbons when measured cold after carbonization 350 - 400 ohms.

163 Carbons when measured cold after carbonization 400 - 450 ohms.

164 Carbons when measured cold after carbonization 450 - 500 ohms.

165 Carbons when measured cold after carbonization 500 and over.

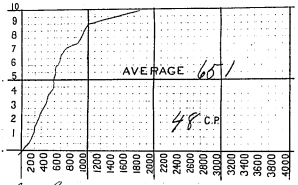
166 Jan 29. 1881.
B. Carbons carbonized for 3 hours and 20 minutes in New furnace.

167 Feb. 1st 1881
Bamboo order no life test

168 " " " " "
169 " " " " "
170 " " " " "
171 " " " " "
172 " " " " "
173 " " " " "
174 " " " " "
175 " " " " "
176 " " " " "
177 " " " " "
178 " " " " "
179 " " " " "
180 " " " " "
181 " " " " "
182 " " " " "
183 " " " " "
184 " " " " "
185 " " " " "
186 " " " " "
187 " " " " "
188 " " " " "
189 " " " " "
190 " " " " "
191 Feb. 1st. 1881.
Bamboo order no life test.

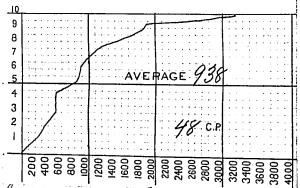
No
192 A. carbons in gas furnace drawing up B. weights.

192



193 Very high resistance from new furnace about 1000 ohms.

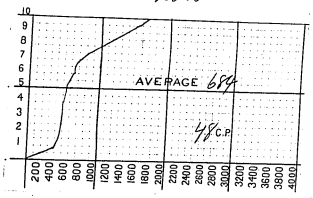
193



194 One Lamp from order 45 marked 1001 R. 278 98 V 13

No.
195 One carbon order 130 put in new globe
196 One carbon form order 123 put in new globe
197 One carbon order 43 in new clamps and globe.
198 Reg. "A" carbonized for 4 hrs as usual A weights. Feby 4th 1881.
199 Reg. "A" carb. for 4 hours as usual in two different chambers. Feby 4th 1881.
200 Bambos order no life test
201 Order 19 in new clamps.
202 A carbons drawing B weights in patent clamps

202



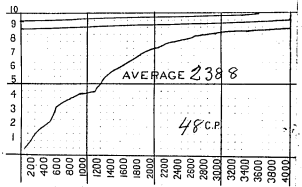
203 Have 12 perfect inside parts without carbons sealed in old style bulb and exhaust.

No

204 Six reg. carbons in new style clamp and let them go through without plating.

205 New ~~carbons by Dr. Hyde.~~

205

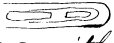


206 B's carbonizing with foot but no top weights.

207 Feby 14th

B's carbonizing without any weights

208 A's carbonizing with a and B top weights in this position



209 B's carbonizing with Top weights only

210 A's carbonizing with weights as in following dia. a weight bring fast

No

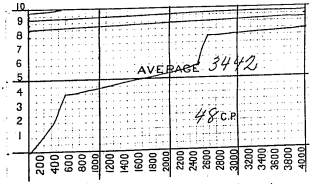
211 Bamboo order no life test.

212 " " " " "

213 Dr Hyde carbons in Platinum clamps.

214 Stock 4 ft long without any joints and in an oval of 1"×¾" diameter Called Narinand. Mr Brannerson says it crumbles up when drying very common along amazon plained to 8/1000 on one side.

214



215 Wet 30 regular carbons with bisulphide of carbon and allow to dry. plated ends in silver clamps.

216 Coat 30 carbons with tar and dissolve off with bisulphide plated ends in silver clamps.

No.

217 Wet 30 carbons dipped in water. Plated ends in silver clamps.

218 Pass the current so as to evolve oxygen from 30 carbons in copper plating cell. Plated ends in silver clamps.

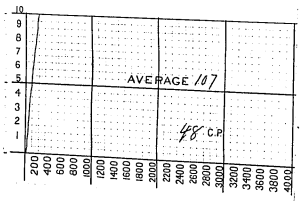
219 Dip 30 carbons into copper solution wash and dry. Plated ends in silver clamps.

Fieby 17th 1881.

220 Bamboo order No lifa Stesh

221 Paper carbons treated by Dr Hard.

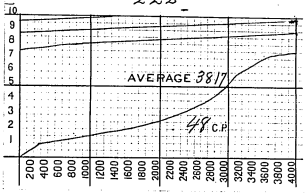
221



220

222 Lamps brought up high on Pumps very quickly from 1 to 1½ Hours

222



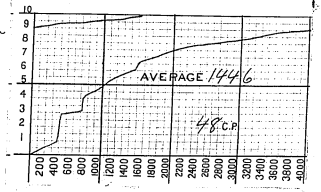
March 1st 1881

223 Carbons from new Double moulds

224 Fibres Mkd No 3. 2nd Lot of Piles from Japan Shipped Jan 15, 1881.

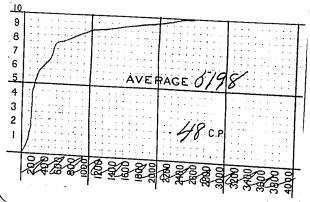
"Yellow and dry" said to be Chinese of wild growth supposed to be Japanese Bamboo Call Madaka from Yokohoma.

224



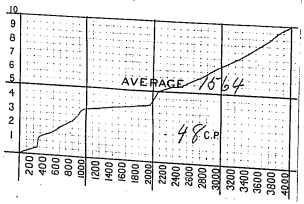
Nos 225 Fibres mkd 1. a.
Yellow but the wood is too old Pith seams are large and coarse. with green stock picked from it.

225



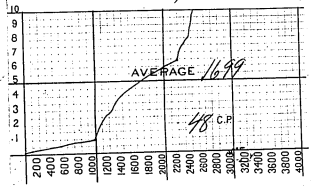
226 Fibres mkd 1. a. x
Yellow but the wood is too old pith seams are large and coarse

226

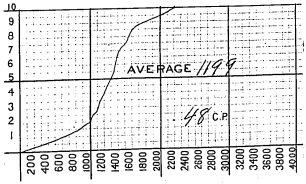


Nos 227 Fibres mkd 2. a. Light green look good about same as nos. with green stock picked from it.

227



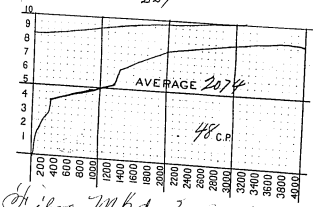
228 Fibres mkd 2. a. x
Light green. look good about same as nos Green stock picked from 2 a.



Nos.

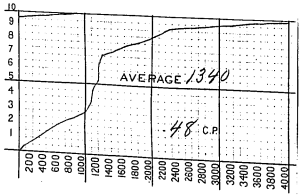
229 Fibres Mkd 3. a. Seasoned fibres
Green but firm fibre very good
with green picked from it.

229



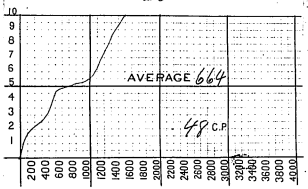
230 Fibre Mkd 3. a. X
Green but firm fibres very good
Green stock picked from 3 a.

230



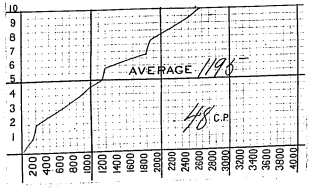
Nos. Fibres mkd 1. b.
231 Green looks better than no 5 Stock
small fibres and close together very
good with green stock picked from it.

231



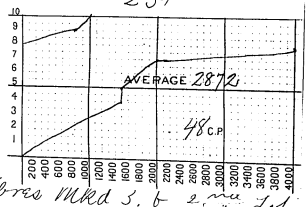
232 Bamboo Order No life test.
233 Fibres mkd 2. b. 2nd Lot.
Seasoned medium cost B.
Green about the same as no 5 Stock
with green stock picked from it.

233



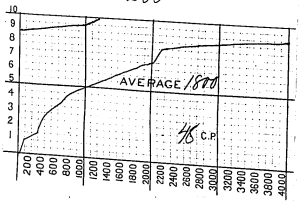
Nos
234 Fibres Mkd. 2. b. X 2. nd lot
medium cost B.
Green about same as No 5 Stock
Green stock picked from it.

234



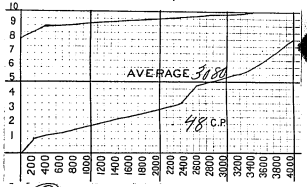
235 Fibres Mkd 5. b 2nd lot
Seasoned most expensive B.
Green and not as good as No 5 Stock
coarse with green stock picked from it.

235



Nos.
236 Bamboo Order No life test
237 " " " " "
238 " " " " "
239 " " " " "
240 Bamboo from Brazil C.E.
Narumal

240



241 Bamboo Order No life test.
242 " " " " "
243 " " " " "
244 " " " " "
245 " " " " "
246 " " " " "
247 " " " " "
248 " " " " "
249 " " " " "
250 " " " " "
251 " " " " "
252 " " " " "
253 " " " " "
254 2 A. Carbons from old No 169 that could not
be raised to incandescence on the Pumps Have
been removed from Lamps and put in new
clamps tested rpd.

No.
255 2 A. Carbons from old No 170 that could not be raised to incandescence on Pumps Have been removed from 2 Lamps and put in new Clamps to be tried.

256 1 A Carbon from Old No 171 that could not be raised to incandescence on 2 the Pumps, have been removed from Lamps and put in new clamps to be tried.

257 One A Carbon from old No 173 that could not be raised to incandescence 2 on the Pumps. Have been removed from Lamps and put in new clamps to be tried

258 Bamboo Order No life test March 17th

259 Bamboo Order No life test
260 " " " " "
261 " " " " "
262 " " " " "
263 " " " " "
264 Carbons high resistance Due to not having enough blast for final heat. 5/26 B on P.6.

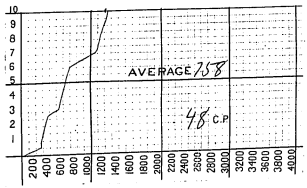
265 Carbons from plumbago moulds.

266 Bamboo order No life test
267 " " " " "

No
268 Bamboo Order. No Life Test.
269 " " " " "
270 " " " " "
271 " " " " "
272 " " " " "
273 " " " " "
274 " " " " "
275 " " " " "
276 " " " " "
277 " " " " "
278 " " " " "
279 " " " " "
280 " " " " "
281 " " " " "
282 " " " " "
283 Lot of Lamps which would not light on the pumps returned to Holger to be rescaled & exhausted.

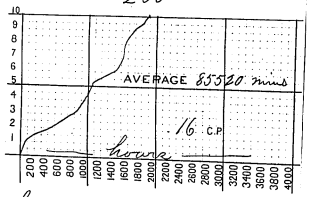
284 Lot of 10 Regulars cu. deposited clamps taken from regular run of A. Lamps to run at 48 candles

284



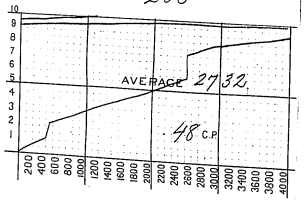
No. 285 Lot of 10 Bigular cu. deposit - clamps taken from late regular runs of A. Lamps. to run at 16 Candles

285



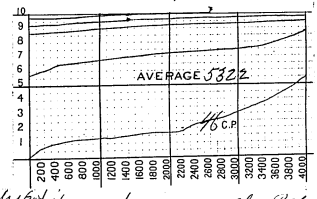
286 Lot of 10 Bamboos with silver clamps to be put up at 48 Candles No 5 - Stock

286



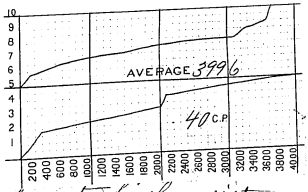
No 287 Twenty (20) Fibres from Large pole stock Note - this is the largest of the cane selected from No 3 Stock and is very best and is about 1½" diameter 6 in + 8 x 17

287



288 Twenty (20) fibres from small Pole stock this is the smallest and poorest of No 3 Stock and is about ⅞" diameter

288

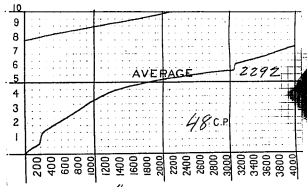


289 Carbons too high resistance for scale.

No
290 Twenty carbons which are to be immersed or washed only to top of shank A. Carbons.
291 Dr Haids Paper (Treated) carbons
292 Bamboo Order No life test
293
April 22, 1881
Twenty Lamps Each lamp with label showing time on Pump.
294 Twenty Lamps From Pumps 576 each lamp to be numbered & time on pumps given. (Capillary)
295 20 Lamps from Pump No 575 (Capillary) each lamp to be numbered & time on pumps given.
296 Bamboo Order No life test.
297 One Hundred (100) Lamps reg. A. Digs carbons finished without additional gloss tips to be carefully tested and laid aside for (6) six months to test vacumns
298 One Hundred (100) Lamps Reg. A. Digs carbons finished with additional gloss tips to be carefully tested and laid aside 6 months to test vacumns.

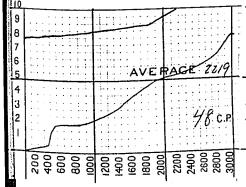
No
299 Fibres treated with Plumbago to be carbonized in regular way (plumbago rubbed into the Fibres in a finely divided state previous to carbonizing)

299

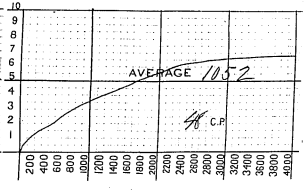


300 Fibres treated with lamp Black and carbonized in regular manner (Lamp black rubbed well into the fibres previous to carbonizing)
301 Fibres Treated with (Plumbago. and carbonized in regular manner.)

300



301



No.

302 Carbons immersed in Sulphate of copper above the shanks and then adjusted to proper height.

303. Plumbago Loops Treated by Dr. Hand (finely coated)

304 Special heated clamps

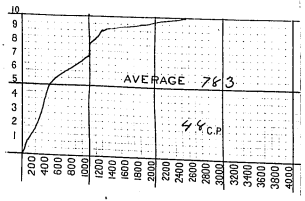
305 50 N. S. Clamps to be hardened by being held in a flame

306 Platinum wires below the clamps on inside parts to be coated with Gutta percha.

307 Lamps from Pump 606 No Phosphorous

308 Lamps from Pump No 605 No phosphorous

308

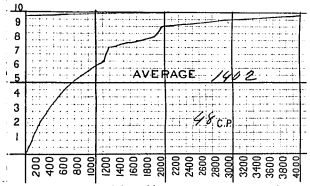


No

309 Bamboo Order No life test

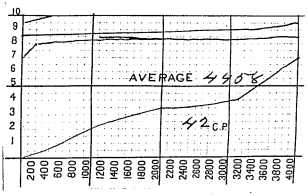
310 Carbons in clamps which after being plated are allowed to remain in solution for four hours, the battery meanwhile being disconnected they were then washed and dried in regular way

310



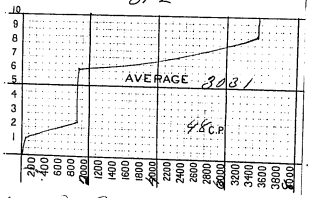
311 Ten Regulars U. Size 8 x 17 to run at 48 candles, to be put up at same time with Order 2874288

311



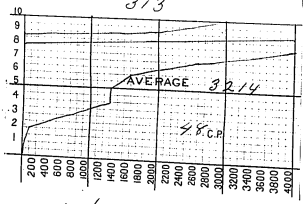
No 312 Twenty carbons not brought up to final heat

312



#313 Regular A. Bamboo carbons treated by Dr Th...

313



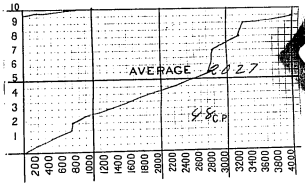
314 Carbons out of graphite forms tested for durability. No life test.

No 315 Carbons out of nickel forms, but heated in the same mould as the previous to be subject to same test as order 314 for purpose of comparison.

May 10, 1881.

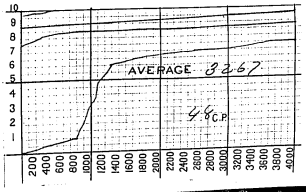
316 Lamps without blue air hanging in tubes. Sealed off hot.

316



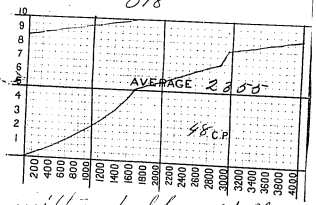
317 Lamps without blue at clamps with air going down in tubes. Sealed off hot.

317



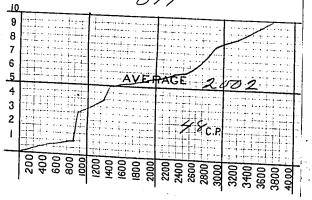
No 318 Lamps without blue at clamps clean fall tubes worked very high and thoroughly. Inspected with high currant. Sealed off hot.

318



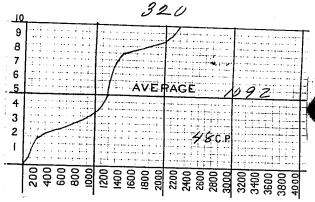
319 Lamps without blue at clamps clean fall tubes worked well. Inspected with moderate currant light blue in globe. Sealed off hot

319



No 320 May 16, 1881 Lamps worked in old way. Brought up to about sixteen candles and run for good tube. Then brought up high and when tube is good sealed off. No account is made of the blue. Sealed off cold.

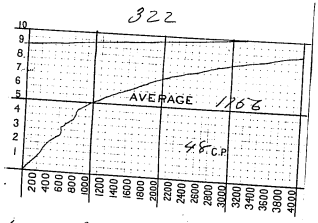
320



321 Lamp No 19 B of order 265. (Tested by Dr Hard) this lamp ran about 190 hours showed some discoloration on globe. on testing for candle power found it gave only 15 candles. put it in new clean globe to be exhausted in regular way and then set at 48 candles.

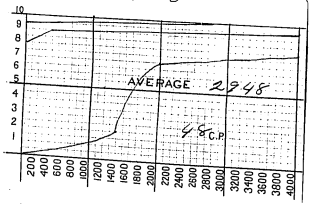
No 322 Lamps without blue air hanging in tube. Sealed off cold.

322



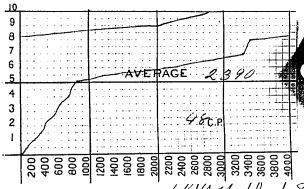
323 Lamps without blue clamps with air going down in tube, Sealed off cold.

323



No 324 Lamps without blue. clean fall tubes worked very high and thoroughly Inspected with high currant sealed off cold

324



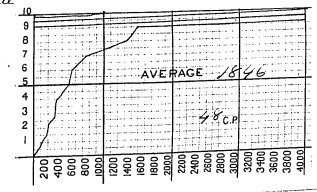
325 Lamps without blue clean fall tubes worked well. Inspected with moderate currant, light blue in globe sealed off cold

May 10, 1881

326 B Size carbons treated by Dr Haid

327-50. Fibres sample Bamboo from Brannner

327



No
328 Bamboo order No life test.

329 Fibres cut with shanks tapering from both sides to prevent the present high incandescence down close to the shanks and clamps. [illegible] insulated off [illegible]

330 6 Spiral Bamboo Lamps

clamped.

331 4 Lamps with Carbons of thread

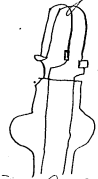
332 Two lamps like previous order 1 plated on the end and clamped 1 with thread rolled in Lamp black and tar.

No
May 12, 1881.

333 Six (6) Lamps with A. Carbons 4 in one globe all in series.

cuplated to wires

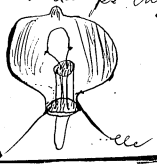
334 Six 6 Lamps Two A. Carbons at right angles to each other.



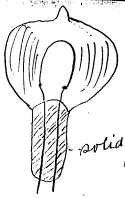
335 Six Lamps with 4 A. Carbons in multiple arc.

2 - .012 wire through the glass.

336 Six Lamps thus.



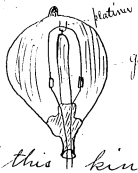
No. 337 Six Lamps thus.



338 Six Lamps thus

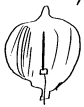
339 Six Lamps thus

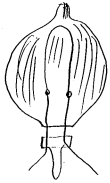
340 Six Lamps thus.



341 Two Lamps of this kind

No. 342 Six Lamps thus.





343 Three of these

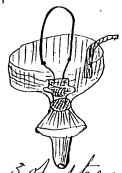
344 Three of these

345 Three of these.

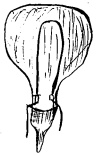
No 346 Six of these.

carbons side by side 3 wires passing out of lamp.

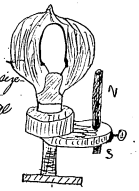
347 Two of these



348 Dr. Moses device 3 of these.

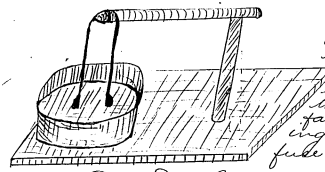


349 One (1) Lamp thus steel magnet like that used in Bell Telephone - same as



This is for effecting change in blue arc.

350 One of this.



note. Peate some carbons on ends - also take piece copper wire flatten and turn round so it will cling to carbon then platy now fasten to platina coming through glass tube as is now done.

351 Try Dr. Moses device for fusing copper to carbon.

352 Two of these.

Line .004 wire platinum iridium

353 Ten Inside Parts with all copper wire.

354 Bamboo order No life test.

355 " " " "

356 Fifty Regular A. Lamps from New Cutting mould.

No room for curve Average minutes 50653

16 Candles

no.
357 Regular A. Lamps Treated by old method with moderate current and sealed off cold.

358 Regular A. Lamps Treated by Dr Haid. (stuck together badly)

359 Bamboo Order No life test

360 Bamboo Order May 26th 1881 No. life test

361 " " " " "

362 " " " " "

363 Regular A. Carbons treated by Dr Haid. not stuck together.

364 Bamboo Order No life test May 31st 1881

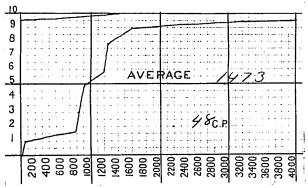
365 Bamboo Order No life test

366 Paper Carbons from Dr Haid new process of treatment

367 Bamboo Order No life test May 31, 1881

no.
368 Regular A and B Carbons 8X13½ very high out of new furnace.

368

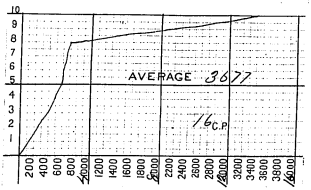


369 Bamboo order Jany 3' 1881.

370 Miscellaneous A & B Carbons.

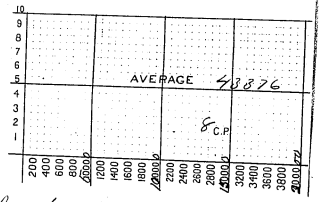
371 10 B Lamps - (8X13½) to be tested at 16 candles

371



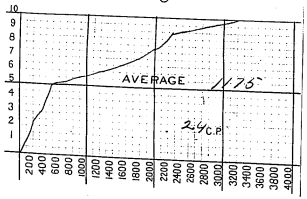
No. 372 10 B. Lamps (8 x 13½) to be tested at 8 candles

372



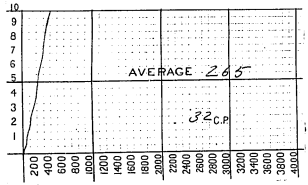
373 10 B. Lamps - (8 x 13½) to be tested at 24 candles the test to be taken together with that of orders 371, 372, 374 as a determination of the life of the lamp as a function of its temperature

373



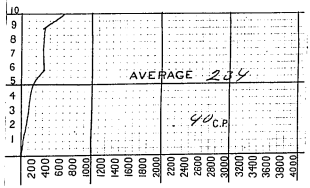
No. 374 10 B Lamps (8 x 13½) to be tested at 32 candles; in connection with orders 371 372 & 373

374



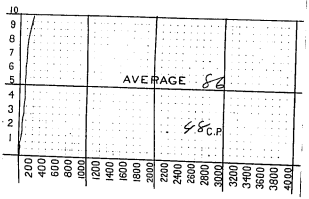
375 10 B. Lamps (8 x 13½) to be tested at 40 candles; in connection with orders 371, 372 373 & 374.

375



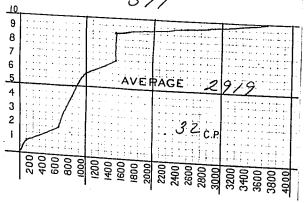
No
376 10 B. Lamps (8 x 13 1/2) To be tested at 48 candles; in connection with orders 371, 372, 373, 374 and 375

376



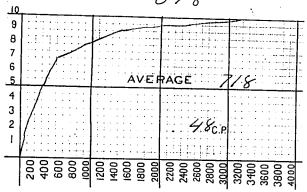
377 10 A. Lamps (8 x 13 1/2) To be tested at 32 candles in connection with order 356 to determine the life of the lamp as a function of its temperature. (Candle power)

377



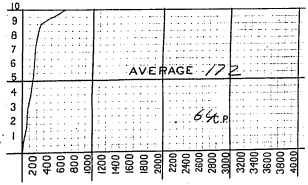
378 10 A Lamps (8 x 13 1/2) To be tested at 48 candles in connection with orders 356 & 377

378



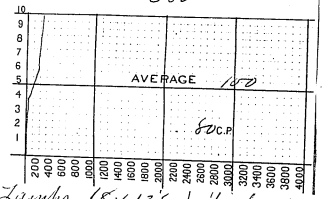
379 10 A. Lamps (8 x 13 1/2). To be tested at 64 candles in connection with orders 356, 377 & 378

379



380 10 A Lamps (8X13½) To be tested at 80 candles in connection with orders 356.377.378-379

380



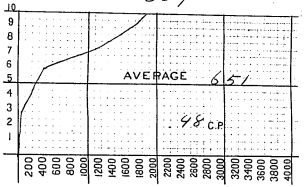
381 - 10 A Lamps (8X13½) To be tested at 96 candles in connection with orders 356.377. 378.379.380

382 A. Carbons bamboo 8X15½ Very high. June 16th 1881.

383 Lamps worked high for short time, switch taken out for half hour, Lamp then inspected with high current giving no blue after the current on for short time.

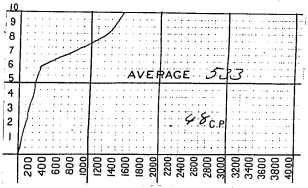
384 Regular carbons (8X13½) 111 Volts (Paris order) 10 Lamps to be tested at 48 candles.

384



385 Regular carbons (8X13½) 104 Volts (London order); 10 lamps to be tested at 48 candles for comparison with order 384

385



386 100 Regular A carbons with clear fine inside parts - high resistance cold - to be tested twice on the E dynamometer Wg when first received and after several weeks interval

No.

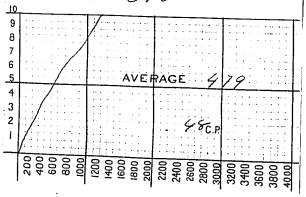
387 100 Regular C. Carbons – Same as order 386 except the Inside parts which are porous and irregular; to be tested in same way as 386 for purpose of comparison.

388 Same as 386
Inside parts with bulbs in seal.

389 Same as 387
Inside parts without Bubbles in seal.

390 Sealed off with "Light blue" in globe.

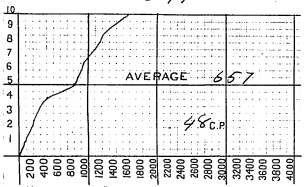
390



No

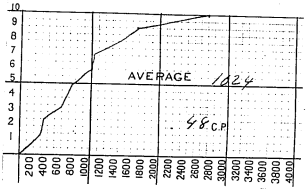
391 Sealed off with "dark blue or violet" in globe

391



39. Heigh carbons very tough.

392



393 Regular 8x17 carbonized at same time and in same mould with 8x13½ to determine whether the 8x17 are affected in like manner as 8x13½ i.e. to see if they are rotten or easily broken at shank.

No.

394 make dog lamps and get 48 candle curve on them the carbons being made thus.

Take regular carbons soak for 3 days in alcoholic solution of molasses (saturated and afterwards filtered) then take out and dry the recarbonize in regular way just as if they were bamboo.

395 Bamboo order no life test

396 Aug 12th 1881.

5 X 13½ regularly carbonized then placed in a mixture of common molasses and alcohol, alcohol added to molasses until precipitation commenced. Then solution set aside and allowed to subside after subsiding, clear liquor decanted. Carbons not immersed in above but in clear liquor decanted therefrom and at the end of 3 days removed. Carbons after removal remained in contact with the air three days and were then immersed for a few moments in alcohol then recarbonized regularly.

No

397 22 B 8 X 25 Aug 13 1881

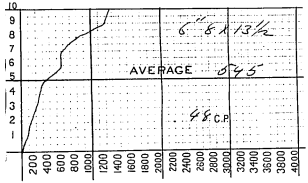
398 50 B 8 X 27 " 16, 1881

399 75 Lamps with clamps japanned.

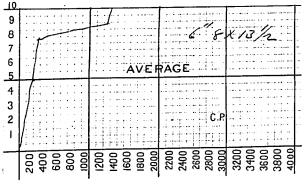
400 Lamps that flash blue

401 Quick sealing Vorhees

401

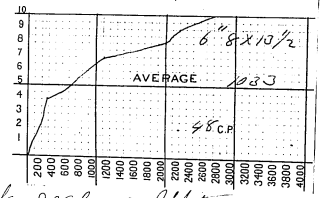


402 Quick sealing Long.



No
403 Quick sealing Laforge.
404 Quick sealing. Whitteer.

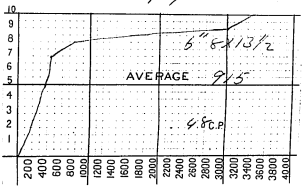
404



405 Quick sealing Upton.
406 Regular Aug 16.1881.
407 Lamps only lighted when worked
408 Lamps that blue hange in and trouble workers.
409 Lamps worked off and record kept in book with numbers
410 Lamps from quick working pumps Voorhees.
411 Brought up without working Wrong

No
412 Work A. Lamps low until good tube then clean clamps. Run for fair tube work the lamps very high hold while counting 20, wait 5 min. work again high wait and work again. Then run for clean tube lamp running low seal off hot.
413 Clamps painted with silicate of soda.
414 Carbons that have been cleaned of copper clamps by dipping in Nitric acid

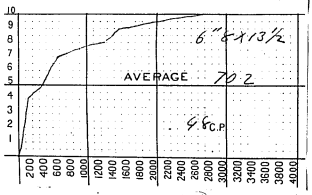
414



Aug 22, 1881

No. 415 Carbons from broken inside parts reclamped without taking off the copper

415



Aug 23, 1881.

416 Lamps brought up slowly lighted only when worked until 3 rays in Colour Resis box. three kept burning worked high and thoroughly till blue disappears then burn moderately high, work no more sealed off solid tube and burning.

417 Lamps that blue hangs in worked for clean tube with straight current.

No 418 Lamps that blue hangs in worked with reversed currents to clean tubes

419 Lamps that blue worked out easily run for clear tube, mark with label on Clamp with blue on it. Test with current in same direction at 48 Candles 8 X 13½ This order changed by Sexelby to lamps that flash blue.

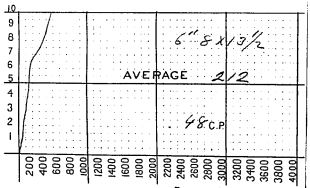
420 Lamps that blue do same as order 419 Test with current in opposite directions to that on pumps clear fall tube (8X13½) Aug 23, 1881. This order changed by mistake to lamps that flash blue Aug 23, 1881.

421 Lamps that are working and run for clear fall tubes using (reversed) currents 8 X 13½

422 25 Lamps worked extremely high. The number of times worked to be mentioned by Cubell. The tubes to be good.

No. Aug 25, 1881.

423 25 Lamps marked very high using reversed currents. The labels to tell how many times lites good.



Aug 29, 1881

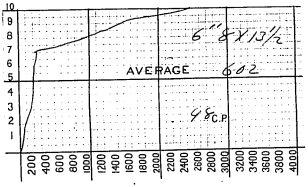
424 25 Lamps worked very high Labels to show how many times worked. Scaled off with Fair lites

425 B. Lamps 8 x 13½ worked exceedingly high.

426 B. Lamps (8 x 13½) worked moderately high.

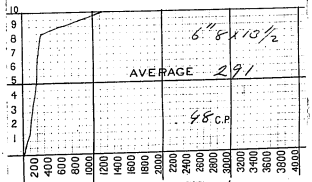
No. Aug 25, 1881

427 High carbons



428 Aug 25, 1881

Low Carbons



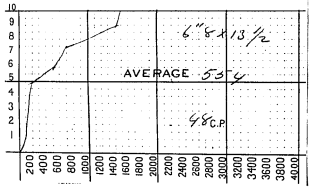
429 Twelve Clamps painted green

430 " " " amber

No 431 (8x13½) Aug. 30, 1881

Danbury, Run off 25 A. Lamps from pumps that air-hardize in Regular Sealing

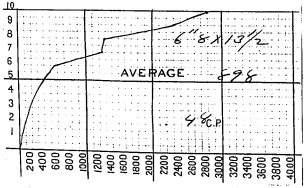
431



Aug 30, 1881

432 Danbury runs off 25 A. Lamps with fair tubes that do not break badly on working

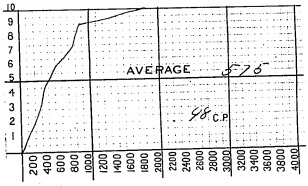
432



No 433 (8x13½) Aug 30, 1881

Danbury Run off 25 A. Lamps that you call first class. Tube that does not break up on working on high.

433



Aug 31st 1881

434 15 A Lamps from regular phosphor-on-rus pump regular working (8x13½) worked by same man as orders 435 & 436

435 (8x13½) Aug 31st 1881

15 Lamps from pumps with drying tube with Ca Cl in it.

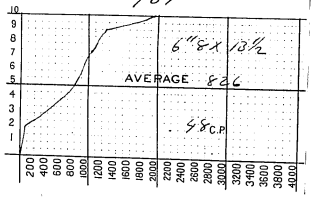
436 (8x13½) Aug 13, 1881

15 Lamps from pumps with drying tube with Li Cl in it

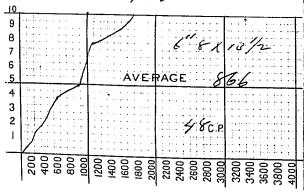
No

Aug 31, 1881

437 Twenty five (8 x 13½) A Lamps from pumps with mercury moving up and down.



438 Twenty five (8 x 13½) A Lamps from pumps good vacuum, results worked by same man as order 437. Aug 31, 1881



No

439 (8 x 13½ Sept. 1, 1881.

Take fifty carbons and split the shanks so that it will be same size nearly as possible of the carbon

440 Sept 1, 1881.

Lamp in photo, room tested by vibration for vacuum sent to H exhaustion by fifties.

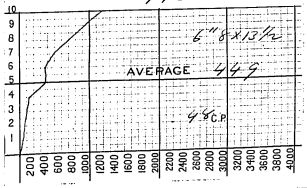
441 Sept. 1, 1881.

Lamps from pumps that do not show good vacuums tested by vibration. Sent for exhaustion by fifties.

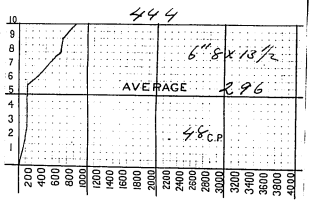
442 Quick sealing Danbury 2½ to 3 hours

443 Sept 3, 1881

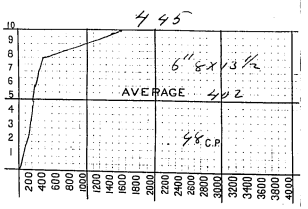
Crosheas selection 15 A Lamps (8 x 13½)



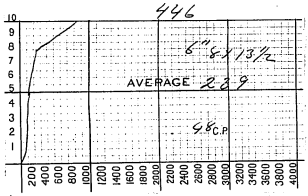
No 444 La Forgéo selection 15 A Lamps. Sept 3, 1881.



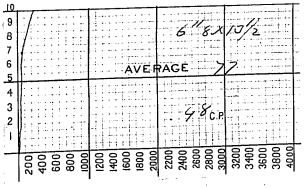
445 Ochilliers selection 15 A Lamps 8 x 13 1/2 Sept 3, 1881



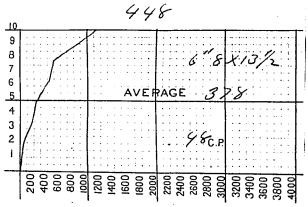
No 446 (8 x 13 1/2) Sept. 3, 1881
Lamps selection 15 A. Lamps.



447 Lamps that have been on pumps over five hours no. blue tube, broke badly and looks badly worked high and often. Lamps that flash blue included



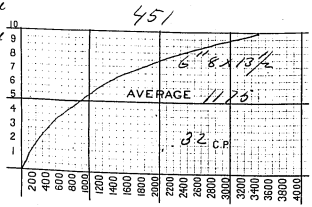
No 448 Lamps without blue or flashing with very poor tubes.



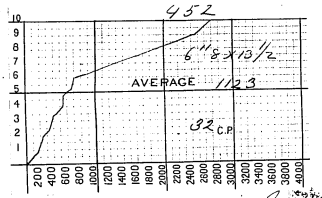
449 - Bad vacuum lamps, tested by vibration. Sent to Mr Holzer to be re-exhausted.

450 High resistance carbons treated for resistance &c in Empty mol. moulite

451 High resistance treated for resistance &c Graphite.

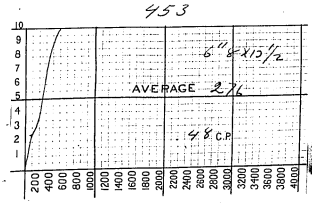


No 452 High resistance treated for resistance &c in Lamp Black.



Sept 19, 1881

453 Twenty (8 X 13 1/2) A Lamps bring up slowly, at first do not allow the blue to rest on clamps when the tube is very poor. Take off when in running up high the tube does not break badly and is the same as regular.



No
454 Twenty (8 X 13½) A. Lamps regular sealing. Sept 19, 1881

455 Twenty (8 X 13½) B. Lamps same as order 453 Sept 19, 1881

456 Twenty (8 X 13½) regular B Lamps Sept 19, 1881.

457 A Standard Inside Parts ¼" full seal with wires burnt quantity 1000.

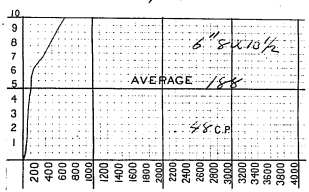
Made by Holzer.

458 Lamps with lost vacuums for which no cause could be assigned air bubbles in tips Sept 21, 1881.

459 Lamps that lost their vacuums for which no cause could be found Clear tips. Sept 21, 1881

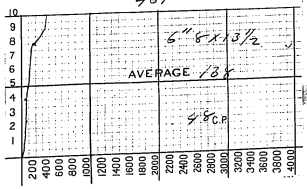
No
460 Lamps with carbons that are black on one side and light on the other current from black side to light. Sept. 21, 1881

460



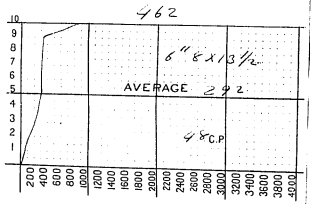
461 Lamps with carbons that are black on one side and light on the other current from light side to the black Sept. 21, 1881

461



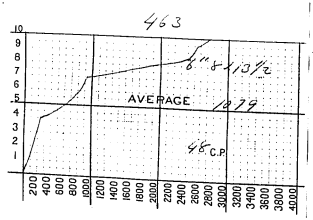
no 462 Sept. 21, 1881

Lamps with carbons black on both sides



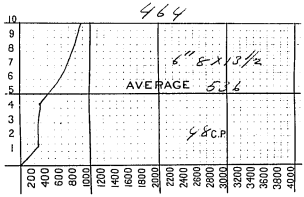
463 Sept 21, 1881.

Lamps with carbons light on both sides



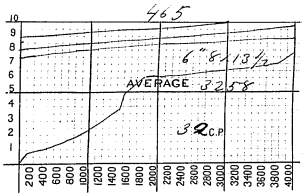
no 464 Sept. 21, 1881

Crooked carbons



465 Sept 21, 1881

Lamps from pump with no Hg seal using glycerine and glue corks.

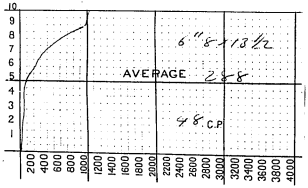


Sept. 27, 1881

466 High resistant carbons treated in charcoal nickle forms

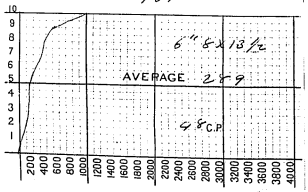
No Sept. 27, 1881
467 High resistant carbons treated in charcoal in Plumbago moved.
468 night run Sept. 30, 1881.

468



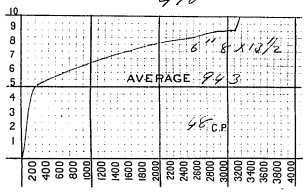
469 - Day run Oct. 3, 1881

469



No Oct 3d 1881
470 Night run

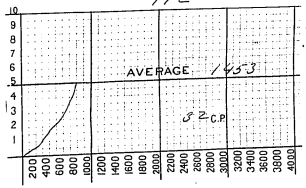
470



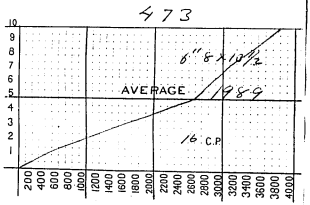
471 Oct 4 1881.
25 Inside parts & carbons run through on without heating.

472 Day run Oct 11, 1881,
a Lamps

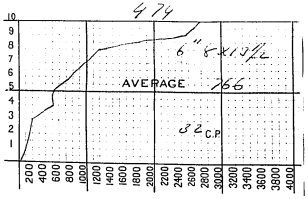
472



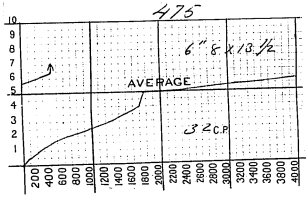
No 473 Daytime B Lamps Oct 11, 1881



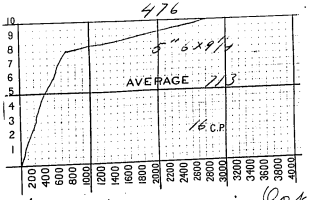
474 Nighttime A Lamps. Oct 11, 1881.



No 475 200 Naranna fibres 8 x 13 1/2 6" long Oct. 14, 1881.



476 Fibres 6 x 9 1/4 5" long tested for life at 16 candles.

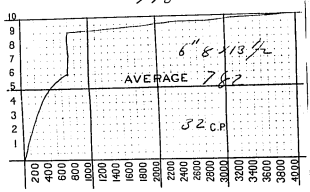


477 25 Lamps from pumps with does stoppers Run for four tubes 8 x 13 1/2 Oct 18, 1881.

No 478 8 X 13½ Oct. 18, 1881.

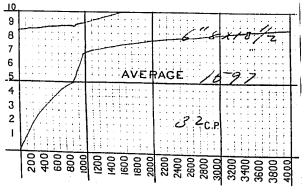
25 - A lamps from glue stoppered pumps ~~wooled~~ in regular way sealed off when blue flashes or no blue Tube mentioned on tag.

478



No 479 Day run A Lamps Oct 28 1881

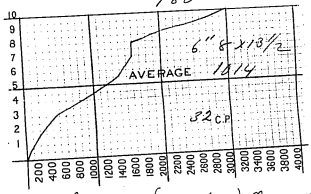
479



No 480 30 A Lamp (8 X 13½) Oct 27, 1881

sealed off with good tube no blue or flashing. test 10 at 32 candles and 10 at 16 candles.

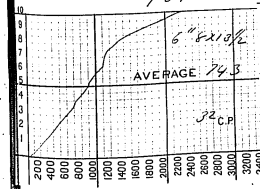
480



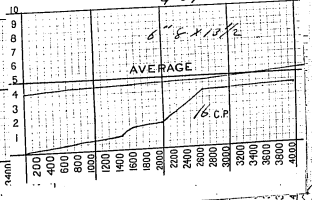
481 30 A. Lamps (8 X 13½) Oct 27, 1881.

sealed off when flashing blue or no blue. test 10 at 32 candles and 10 at 16 candles.

481



481

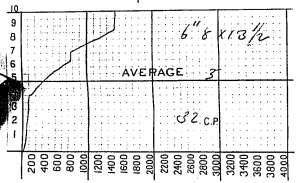


No. 482 35-Lamps 8X13½ Nov 2, 1881

Lamps only worked when the tube is fair in usual manner all other ways sealed off same as regulars with fair tubes and no blue or flashing test at 16 and 32 candles.

Run 2000 minutes at 16 Candles.

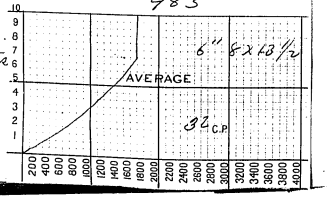
482



483 35-Lamps 8X13½ Nov 2, 1881

Lamps worked by holding the high current on for a short time by running down the box. otherwise regular sealing test at 16 & 32 Candles Run 2000 minutes at 16 Candles

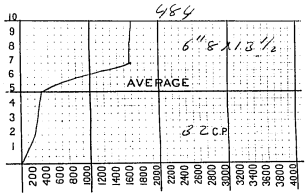
483



No 484 35-Lamps 8X13½ Nov. 2, 1881.

Lamps worked from start with strong current sealed off with fair tubes no blue or flashing.

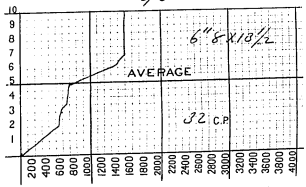
484



485 Nov 2, 1881

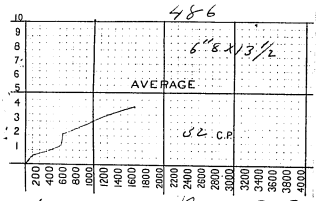
35-Lamps 8X13½ Lamps worked moderately moderately high inspected moderately high. sealed off with fair tubes no blue or flashing blue.

485



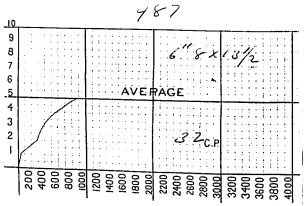
No 486. 35 Lamps 8x13½ Lamp worked regularly

Nov 3, 1881



487 35 Lamps 8x13½ Lamps worked regularly inspected regularly then burned low for 10 minutes before sealing off.

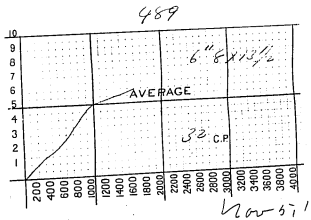
Nov 3, 1881



No 488 7 A Lamps have been lit up on Pumps for 3 hours air going down tube while lamp is burning. tube gets solid immediately when lamp is put out lit up at 16 Candles. to see if they lose vacuum through inside parts. — All from pumps with new style off glue stopper.

Nov 4, 1881

489 Day run Nov 5, 1881 A Lamps



Nov 5, 1881

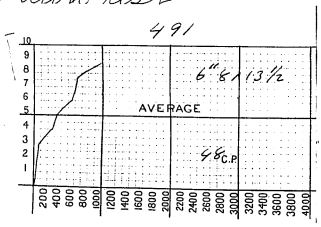
490 Lamps with carbons that have been run through a second time to lower resistance. Treated regularly on Pumps tested for life at 16 candles and 32 candles

No 491 Nov. 8. 1881

100 A Lamps 8×18½

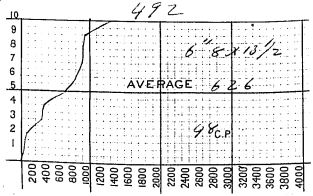
100 Inside pts with soft platinum wires regular carbons.

Test 10 of these for 48 hours 16 Candles 10 at 32 candles 24 hours keep the rest and notice the state of vacuum before putting to one side and also at the end of 4 weeks and 3 month by vibration test



492 Nov 9 1881

Same as order 491 with the exception of that hard platina wires are used



No 493 Nov 9, 1881

100 A. Lamps 8×18½

100 Lamps with the seal made with great care and in every way perfect

Test 10 at 16 candles for 48 hours and 10 at 32 Candles for 24 hours

Note the state of globes and vacuums on lamps burning at and keep the remainder and notice the state of the vacuums before putting away 1 and also at the end of 4 weeks and 3 mos. by vibration test.

494 Nov. 9 - 1881

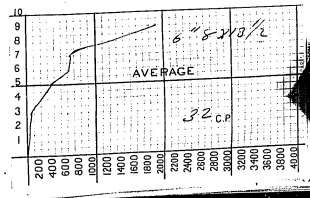
Same as order 493 except that ordinary care is used in sealing.

495 Nov 9 - 1881

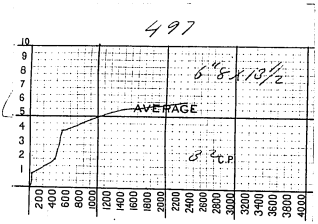
Same as order 493 except that the glass is melted together without blowing using but little care

496 Nov 9 - 1881

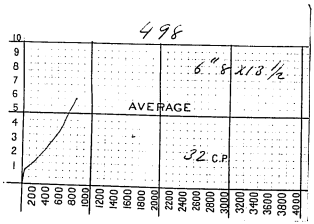
Day run A Lamps



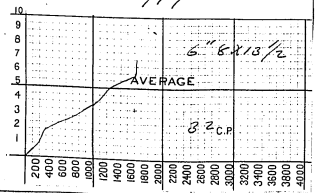
No 497 Night run A Lamps Nov 8, 1881



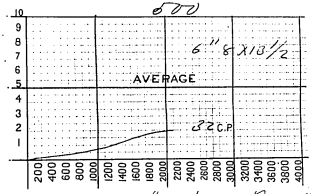
498 Nov 10, 1881
Day run
A Lamps



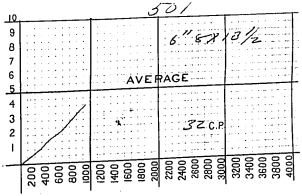
499 Nov 9, 1881
Night run
A. Lamps



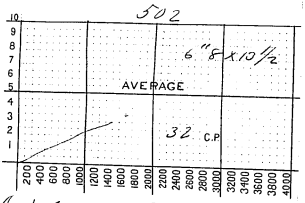
No 500 A Lamps brought up quickly until there are three pegs in lower box - then worked regularly - sealed off with solid tube worked from Pump with new rubber seal. Nov. 11th 1881.



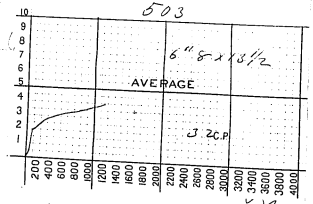
501 Day run A Lamps Nov. 11, 1881.



No. 502 Night run A lamps Nov 10, 1881



503 Night run A. lamps Nov 11, 1881.



504 Nov 12, 1881

Carbon soldered into clamps with lead solder —

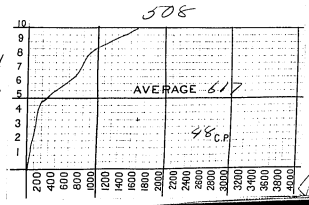
No. 505 35 lamps 8 X 13½ Nov 15, 1881

Carbons from regular run plated by Lawson sealed in globes immediately then dried and exhausted as quickly as possible.

506 35 lamps 8 X 13½ from old carbons dried globes and exhausted. Nov 15, 1881

507 35 lamps 8 X 13½ lamps that have been sealed in for longest time dried and exhausted. Nov 15, 1881

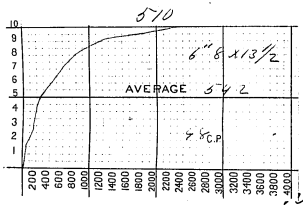
508 35 lamps worked as follows. when tube is solid put in switch on B current when tube gets solid again pull out upper pieces continue to work only on solid tubes and one peg at a time until 3 pegs are in lower box on A current then work regularly and seal off with solid tubes. Nov 15, 1881.



210
509 8X13 1/2. Nov 16, 1881

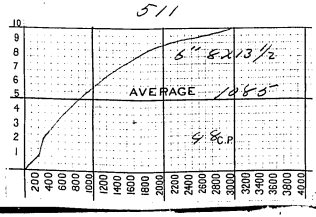
Lamp that had been heated thoroughly to drive out moisture Put on pump and worked up very gradually to high Two hours on pumps.

510 Lamps worked very quickly from Start tested at 48 candles.



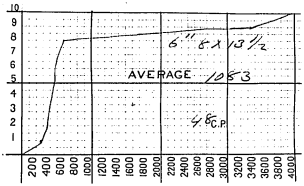
511 Nov 15, 1881

30 Regular lamps that have been heated three times in a gas flame to expel moisture then sealed on the tip - The tip to be broken off just before placing on the pump.



210 Nov 16, 1881.

512 Lamps heated and tipped as in order 511. and worked quickly on pumps tested at 48 candles

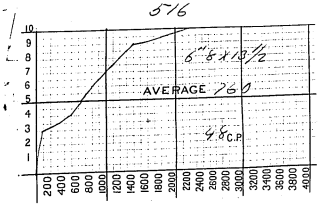


513 Day run A. Lamps Nov 14, 1881

514 Night run A Lamps Nov 14, 1881.

515 Day run A. Lamps Nov 15, 1881.

516 Night run A Lamps Nov 15, 1881

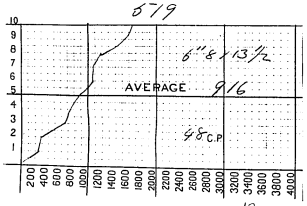


No.

517 Day run A Lamps Nov 16, 1881.

518 Nov 17, 1881
Lamps heated and tipped - the vacuum produced by heating being noted before putting on pumps.

519 Lamps with carbons made from fibres cut by R. McKune.



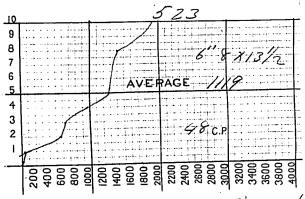
520 A Lamps. 8 x 13½ Nov. 17, 1881
Lamps with carbons made from fibres cut by Pyatt

521 A. lamps 8 x 13½ Lamp with carbons made from fibres cut by Byrne.

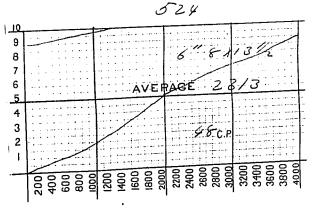
522 A. lamps 8 x 13½
Lamp with carbons made from fibres cut by Van Sickle.

No. Nov. 17, 1881

523 A. lamp 8 x 13½ Day run. 48 candles

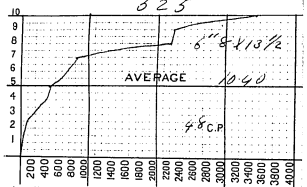


524 Nov 16, 1881.
A Lamps 8 x 13½ night run 48 candles



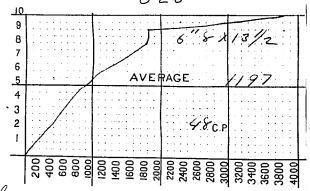
No 525 Day run A. Lamps 8 X 13½. 48 candles Nov 18, 1881

525



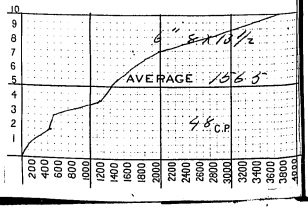
526 night run A. lamps 8 X 13½ 48 candles Nov 17, 1881

526



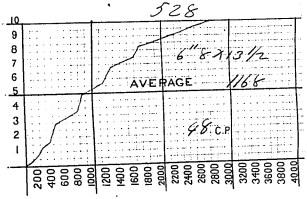
527 night run Nov 18, 1881
A. lamps 8 X 13½

527



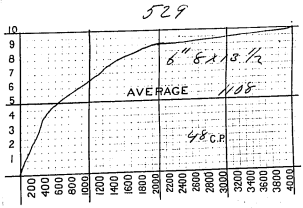
No 528 Day run A Lamps 8 X 13½ 48 candles Nov 19, 1881

528

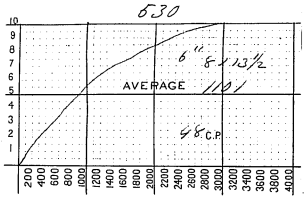


529 Day run A. Lamps 8 X 13½ 48 candles. Nov 21, 1881

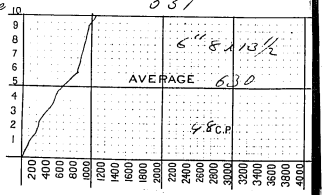
529



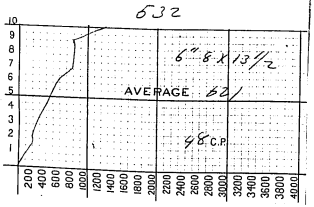
No 530 night run A Lamps 8X13½ 48 Candles Nov 21, 1881



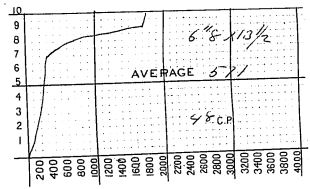
531. Nov 22, 1881. Day run A Lamps 8X13½ 48 candles



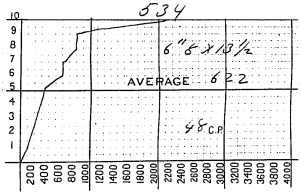
532 Nov 22 1881 night run A Lamps 8X13½ 48 Candles



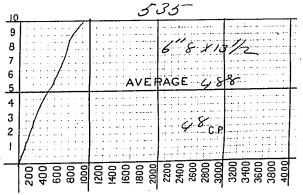
No 533 Day run A Lamps 8X13½ 48 Candles Nov 23, 1881



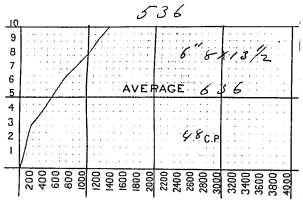
534 Nov 23, 1881 night run A Lamps 8X13½



535 Nov 28, 1881 Day run A Lamps 8X13½



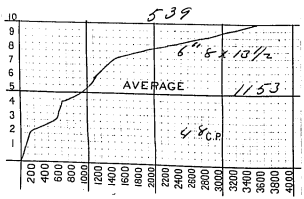
No 536 night run A. Lamps 8X13½ Nov 28, 1881



537 Nov 29, 1881 Fibres carbonized straight and bent afterwards A. Lamps 8X13½

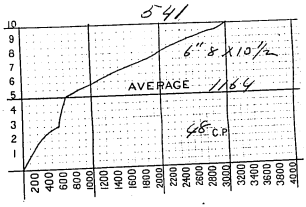
538 Day run A. Lamps Nov 29, 1881 8X13½

539 Night run A. Lamps 8X13½ Nov. 29, 1881



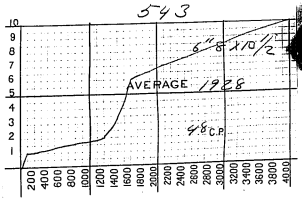
No 540 Day run A. Lamps 8X13½ Nov 30, 1881

541 night run A. Lamps 8X13½
These lamps were heated before putting on the pumps.

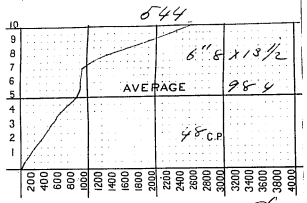


542 Dec 2, 1881
Lamps turned brown

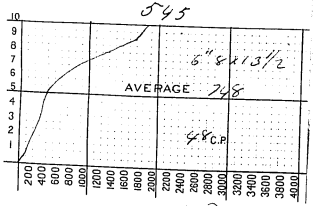
543 Regular lamps ran in usual manner with a tin case on them while on the pumps



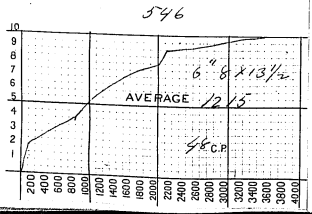
No. 544 night run A Lamps 8X13½ Dec 1, 1881



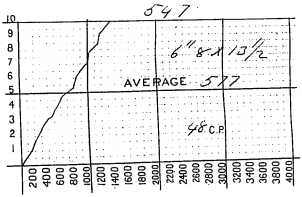
545 Day run A Lamps 8X13½ Dec 1, 1881



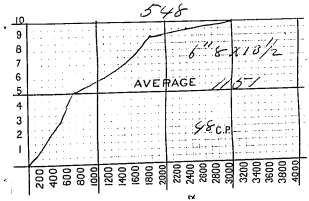
546 Day run A. Lamps 8X13½ Dec 2, 1881



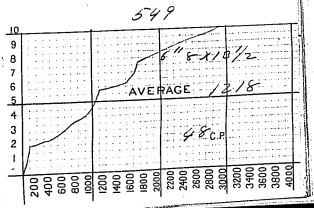
No 547 Night run A Lamps 8X13½ Dec 2, 1881



548 Day run A. Lamps 8X13½ Dec 3, 1881

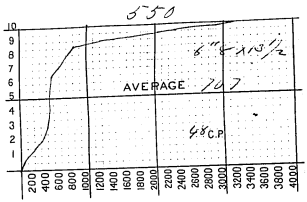


549 Day run A Lamps 8X13½ Dec 5, 1881.



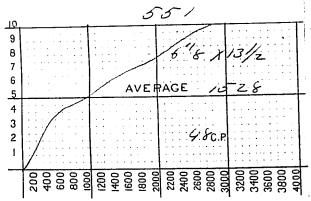
550 Dec 6, 1881

Day run A. Lamps 8X13½



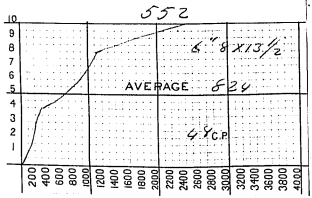
551 Dec 6, 1881

C Night run
A Lamps
8X13½



552 Dec 7, 1881

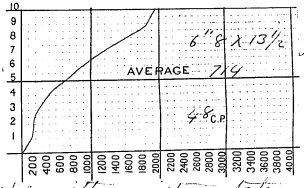
C Day run
C A. Lamps
8X13½



No 553 Night run A Lamps 8X13½ Dec 1/1/81

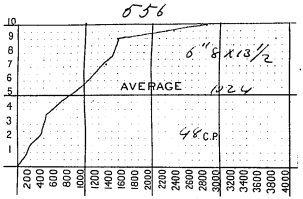
Avg mins 8.16
48 C.P.

554 Dec 7/1/81
Lamps heated in tin cases while on pumps



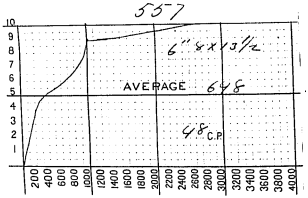
555 Lamps with moisture taken out with air-pumps - then heated and sealed at the tip exhausted without tin cases.

No 556 Lamps worked quickly in tin case



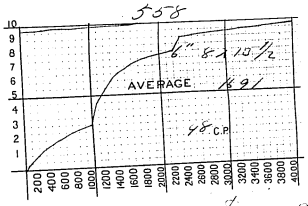
557 Dec 9, 1881.

Regular lamps (moisture taken out with air pumps) heated with alcohol lamp just before putting on pumps



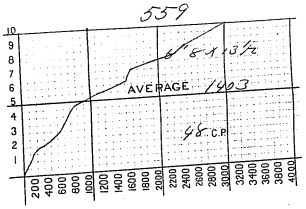
No 558 Dec 8, 1881

Day run A. Lamps 8 x 13 1/2



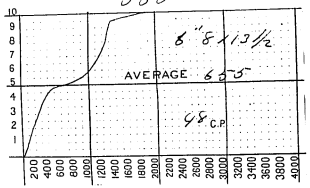
559 Dec 8, 1881

Night run A Lamps 8 x 13 1/2



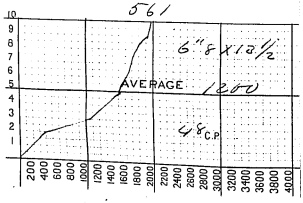
No 560 Lamps brought to Wredon B. current – then brought up high on A. current & let burn high until lamp gets solid

560



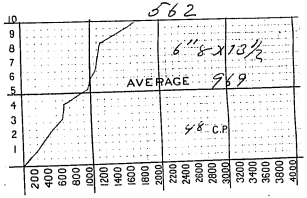
No 561 Day run Lamps 8 X 13½ Dec 10 1881

561



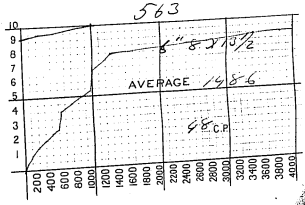
No 562 Day run A. Lamps 8 X 13½ Dec 12, 1881.

562

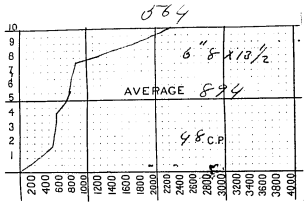


563 Night run A. Lamps 8 X 13½ Dec 12, 1881

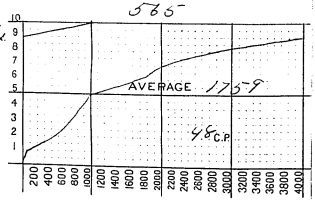
563



No 564 Lamps with extra long seals ½" seal 1" Plat.

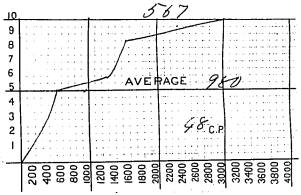


565 Dec 13, 1881
Day run A Lamps 8 x 13½

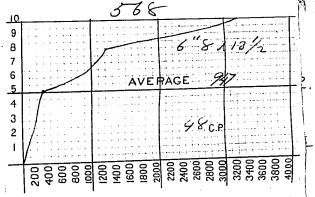


566 Night run A Lamps 8 x 13½ Dec 13, 1881

No 567 Dec 14, 1881
Night run A. Lamps 8 x 13½

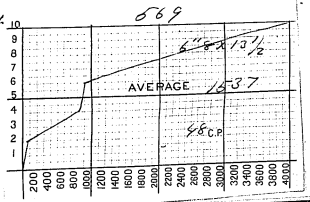


568 Dec 15, 1881
Day run A Lamps 8 x 13½

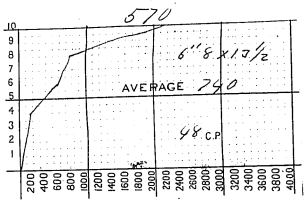


Dec 16, 1881

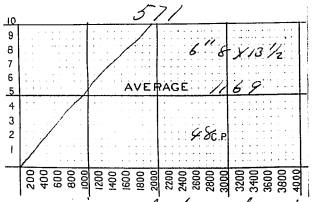
569 Regular lamps covered with varnish after candle power is taken.



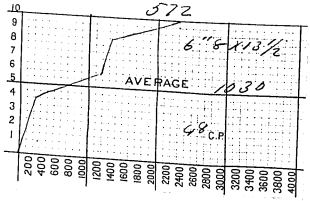
No 570 Night run A Lamps 8X13 1/2 Dec 15. 1881.



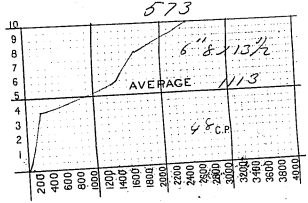
571 Dec 16, 1881
Day run A Lamps 8X13 1/2



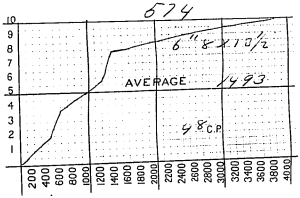
572 Lamps heated just before putting on pumps
8X13 1/2 Carbons



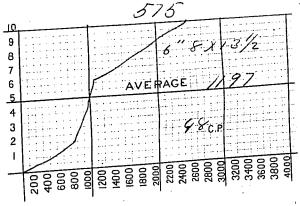
No 573 Night run A Lamps 8X13 1/2 Dec 16, 1881



574 Day run A Lamps 8X13 1/2 Dec 17, 1881

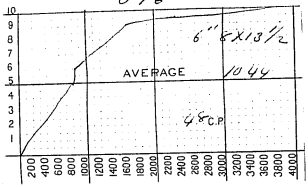


575 Dec 19, 1881, regular lamps day & night.



No 576 Reg. A Lamps 8X13½ Dec 20, 1881
day & night

576

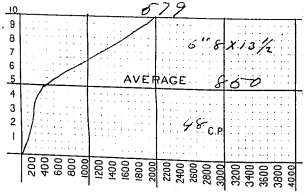


577 Spiral carbons high heat

578 Spiral carbons very high heat

579 Day and nigh run a Lamps Dec 21, 1881
8X13½ P

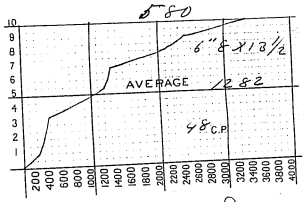
579



580 Dec 22, 1881

Day & night run A Lamps 8X13½

580



581 Jan 11, 1882.

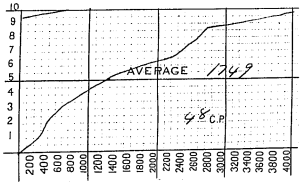
Spiral carbonized in wood charcoal.

582 Spiral carbonized in Jan 11, 82.
wood charcoal and Kaoline.

583 Jan 9, 1882

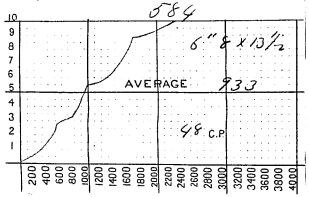
Day & night run A Lamps 8X13½

583



No 584 Day & night run 8x13½ A. Lamps containing 5 lamps from Danbury 5 from Ring 2 from Harvey 2 from Kitch and 1 from each of the day men

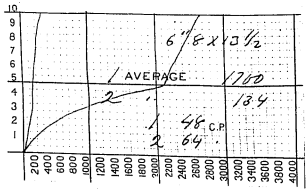
584



585 Jan 12, 1882.

10 Lamps one clamp of each copper plated and other nickle plated Order A. T. A Edison

585



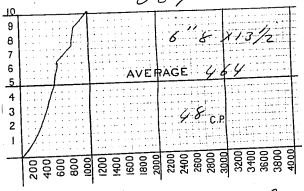
No 586 10 Regular lamps plated with palladium.

587 10 Regulars plated with gold

588 6 B Lamps plated half way up the incandescing part.

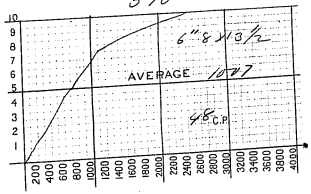
589 20 regulars plated with Nickel

589



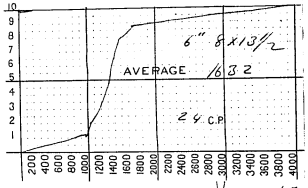
590 Day & night run A. lamps 8x13½ Jan 11, 1882.

590



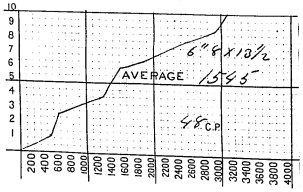
No 591 Day & night run A lamps Jan 12, 1882.
8 x 13½ 24 candles

591

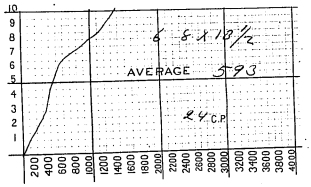


592 Jan 13th 1882.
Lamp flash on pumps
593 Day & night run A lamps Jan 13, '82
8 x 13½ 48 candles.

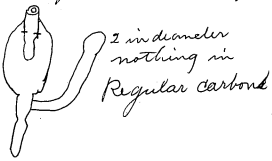
593



No 594 Day run B lamps Jan 14, 1882.
8 x 13½
24 candles



595 Jan 6 1882.
3 of these as copy below



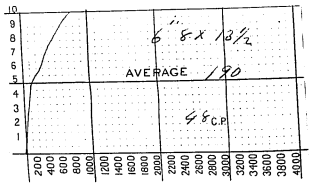
No 596 T. A. E. Jan 6, 1882.

10 of these

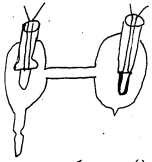
Regular carbon

Cocoanut charcoal about size of pea so it can be heated by lamp while on pump make glass holding charcoal thick so it can not draw in,

596



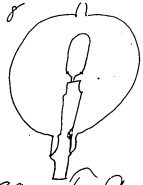
No 597 T. A. E. Jan 6, 1882.



Double Lamp one opening into the other

Regular carbons 2 of these.

No 598

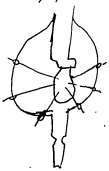


10 of these 6 inches in diameter,

Regular carbons

599 T. A. E. Jan 6. 1882.

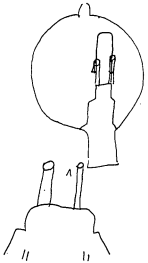
2 of these



platinum wire.

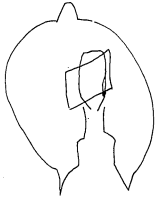
Regular carbon.

No 600 T. A. E. Jan 6, 1882



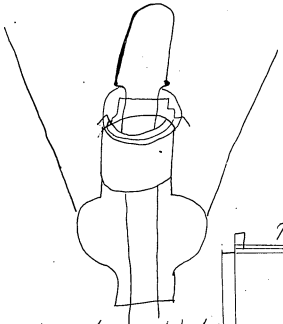
glass 1/2 way up the carbons 3 of these Reg. carbon.

601 T. A. E. Jan 6, 1882.



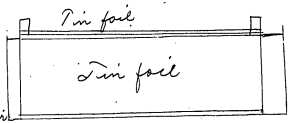
Glass partition dont use window glass as it breaks use thin blown glass 1/2 doz of these lamps.

No 602 T. A. Edison Jan 6, 1882.



9 of these condensers

6 inches long inch wide



parchment paper

603 T. A. E. Jan 6, 1882.

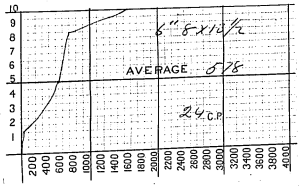
Ten (10) Lamps German Glass H carbons.

604 Jan 16, 1882

Day run 13 lamps 8 X 13 1/2

24 candles

604

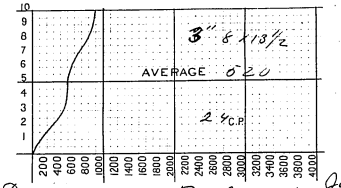


Charles Batchelor Notebook, Cat. 1302

This notebook covers the period January-August 1882. All of the entries are by John W. Howell. The book contains notes and graphs of electric lamp experiments, which are numbered 605 through 981. The spine is labeled "Expt 604-981." The cover is marked "2." There are approximately 140 unnumbered pages.

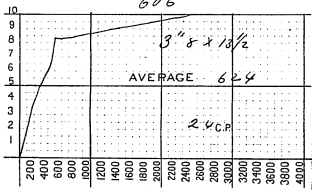
No 605 Night run Jan 16th 1882
B lamps 8 x 13 1/2

605



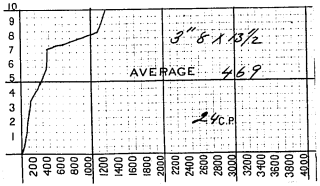
606 Day run B. lamps 8 x 13 1/2 Jan 17, 82.

606



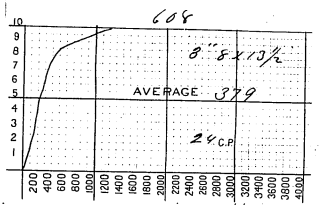
607 Night run
B lamps 8 x 13 1/2
Jan 17, 1882.

607



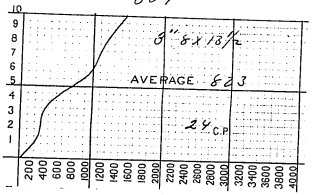
No. 608 Day run B lamps 8 x 13 1/2 Jan 18, 1882

608



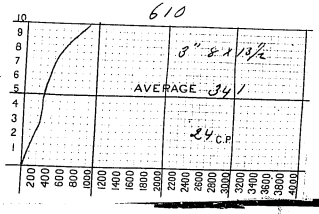
609
Night run B
Lamps 8 x 13 1/2
Jan 18, 1882.

609



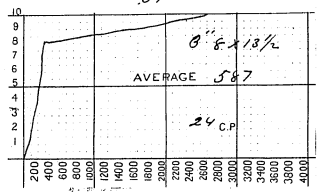
610 Jan 19, 1882.
Day run B lamps
8 x 13 1/2

610



No 611 Night run B lamps 8 X 13½ Jan 19, 1882.

611



612 Narrow B carbons plated over 4/5 of their length.

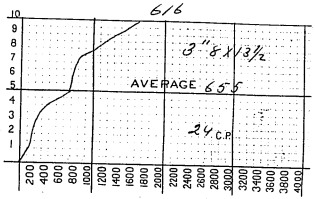
613 Narrow B. carbons plated over 7/10 of their length.

614 Narrow B carbons plated over 3/5 of their length.

615 6 Lamps plated without attaching wires through inside parts.

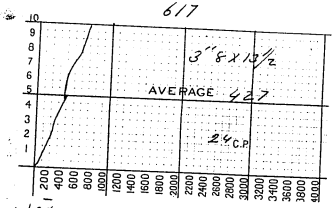
No 616 Day run B lamps 8 X 13½ Jan 20, 1882.

616



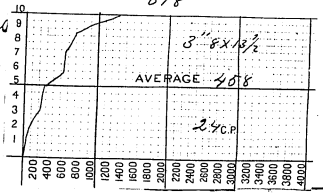
617 Night run B Lamps 8 X 13½ Jan 20, 1882.

617

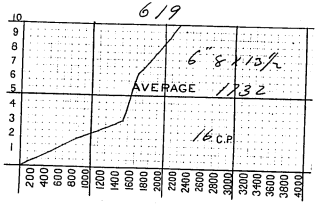


618 Jan 21, 1882. Day run B lamps 8 X 13½

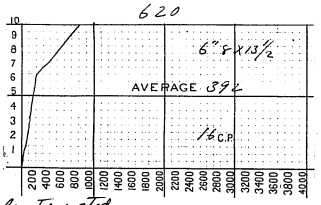
618



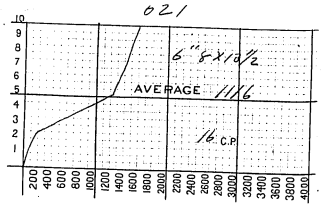
No 619 Spiral treated with oil of petroleum



620 Spirals treated with oil of spruce



621 Spirals treated with oil of Jasmin.

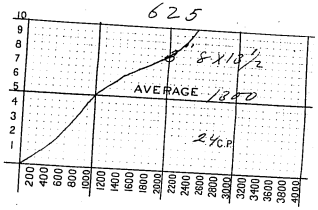


No 622 Spiral - Jakel carbons

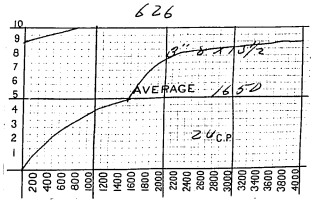
623 Spirals - Wood carbons burnt 5 1/2 hours

624 Spirals - Wood carbons

625 Day run B. Lamps 8 X 13 1/2 Jan 23, 1882.



626 Night run B. Lamps 8 X 13 1/2 Jan 23, 1882

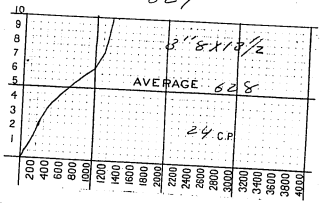


No. 627 15 lamps with a carbons made the same as order 596 but with old style of platinum clamps.

No 628 15 Lamps like order 626 with nickel plated clamps

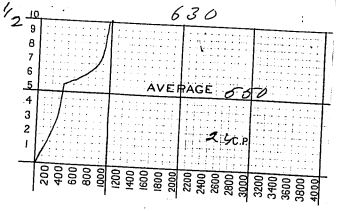
629 Day run B. Lamps Jan 24, 1882 8 X 1 3/2

629



630 Night run B Lamps 8 X 1 3/2 Jan 24. 1882

630



No

631 Day run B. lamps Jan 25, 1882 8 X 1 3/2 24 candles

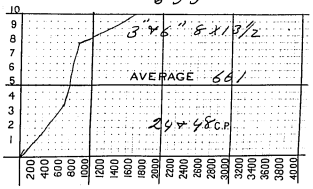
632 Night run A + B lamps 8 X 1 3/2 + 8 + 24 candles.

633 1/2 doz. A Lamps with O_2 O_3 in bottle at end of stem while on the heater thus

634 Special Lamps for Mr. A. E. Jan 14th 1882

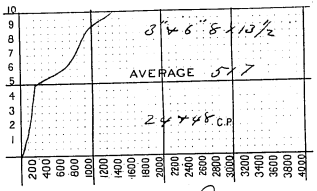
635 Day run a + B. lamps Jan 30, 1882. 8 X 1 3/2

635



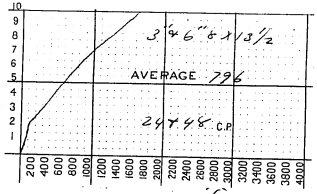
No 636 Day run A & B lamps Jan 31, 1882.

636



637 Night run a & B Lamps Jan 31, 1882.

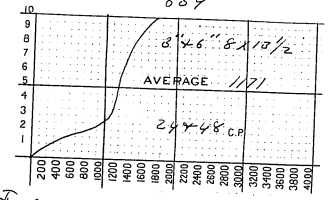
637



638 Feb. 2, 1882
25 Lamps with spotted carbons.

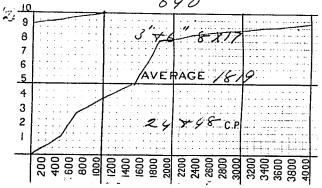
No 639 Day run a & B lamps. Feb 1, 1882

639



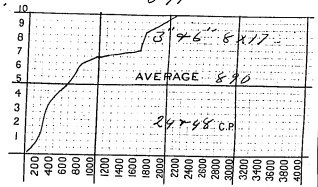
640 Feby 1, 1882.
Night run a & B Lamps

640



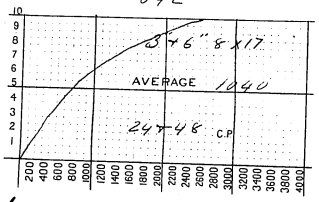
641 Feb. 2, 1882.
Day run a & B Lamps.

641



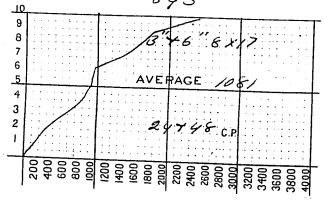
No 642 Feb. 2, 1882.
Night run A & B lamps.

642



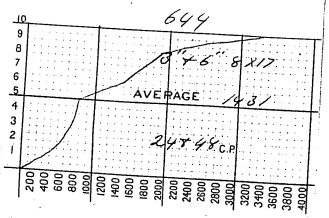
No. 643 Feb. 3, 1882.
Day run A & B Lamps

643



No 644 Night run A & B lamps
Feb 3, 1882.

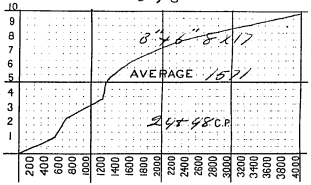
644



No 645 25 High resistant carbons. Feb 4, 1882

646 Day run A & B. Lamps Feb 4, 1882

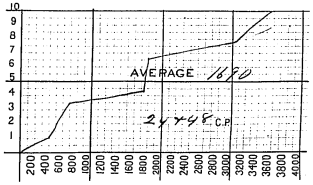
646



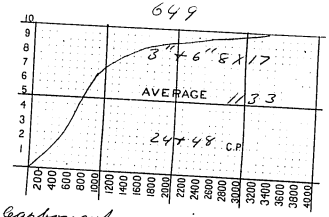
647 10 A. Carbons run of Feb 6, 1882.

648 Day run A & B Lamps. Feb 6, 1882

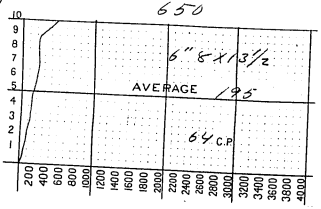
648



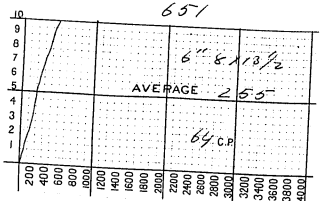
No 649. Feb. 6, 1882.
Night run A & B Lamps,



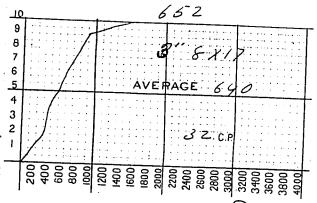
650 Carbons of Feb 4.-5. marked 5-8/00 A.



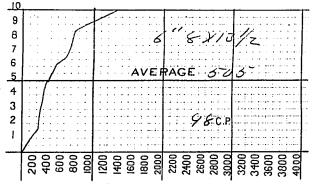
651 Carbons of Feb. 4 + 5th marked 3-4/00 A



No 652 Carbons of - - - - Feb. 4-5 marked 1-7/8 X 18.

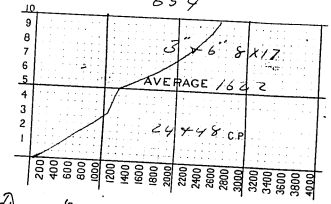


653 Carbons brought from high to low resistance, Feb. 9, 1882.



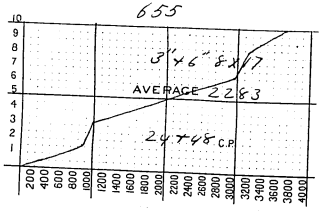
No 654 Day run A + B Lamps Feb 7, 1882.

654



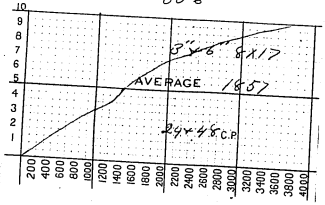
655 Feb 7, '82.
Night run A+B Lamps.

655



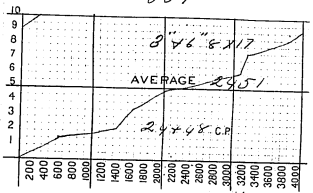
656 Feb 8, '82.
Day run A+B. Lamps.

656



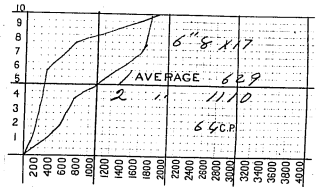
No 657 Night run A + B Lamps Feb. 8, 1882.

657



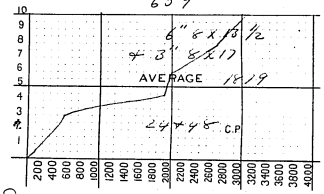
658 Feb. 11, 1882.
12 Lamps with two A. Carbons at right angles arrange wires so that either can be burned.

658



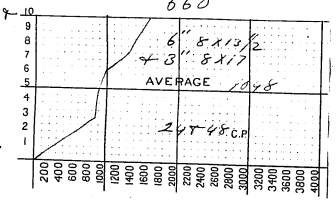
No 659 Day run A & B Lamps. Feb 9, 1882.

659



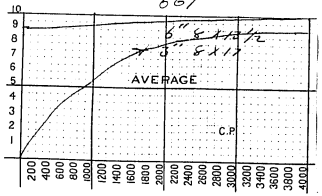
660 Feb 9.82 Nightrun A & B Lamps

660



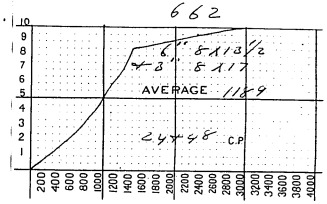
No 661 Feb 10, 82 Day run A & B Lamps.

661



No 662 Night run A & B Lamps. Feb 10, 1882.

662



663 B carbons run of Feb. 3, 1882, brought from high to low resistance.

664 A Lamps marked $\frac{59}{XX}$ Feb. 6 & 7, 1882.

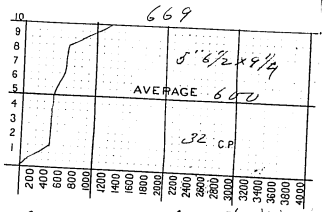
665 A Lamps marked $\frac{60}{X}$ Feb. 6 & 7. 1882.

666 B " " $\frac{115}{Reg\ 6}$ " 7 & 8, 1882.

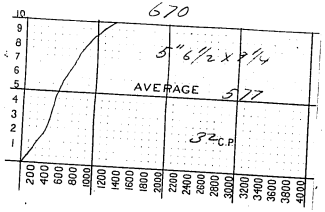
667 B " " $\frac{116}{Reg\ 0}$ " 7 & 8, 1882.

668 B " " $\frac{119}{Pl.\ P.\ 000}$ " 7 & 8. 1882.

No 669 A. Lamps marked $\frac{6\text{w}}{00}$ Feb. 7 & 8, 1882.

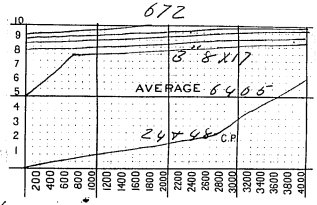


670 A. Lamps marked $\frac{5\text{w}}{00}$ Feb. 7 & 8. 1882.

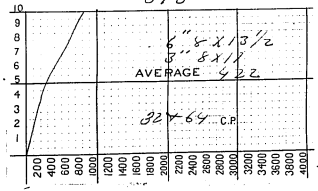


671 B. Lamps marked $\frac{4\text{w}}{\text{Th. P. 000}}$ Feb. 7 & 8 1882.

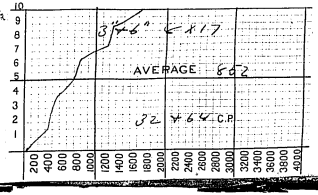
No 672 Day run A & B Lamps Feb. 11, 1882.



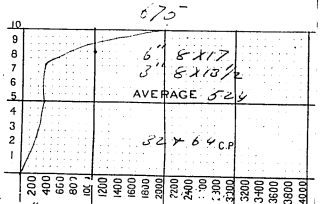
673 Day run A & B. Lamps Feb. 13, 1882.



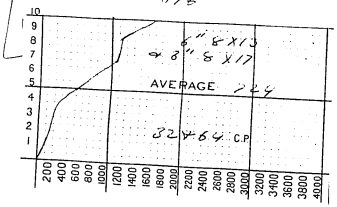
674 Night run A & B lamps Feb. 13. 1882.



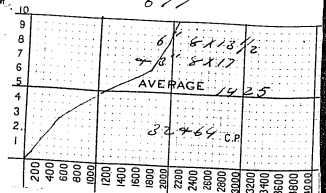
No. 675 Day run A & B. Lamps Feb. 14, 1882.



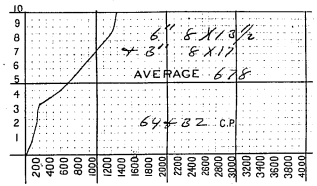
676 Night run A. & B. Lamps Feb. 14, 82



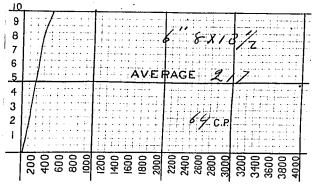
677 Day run A. & B. Lamps, Feb. 15, 1882.



No. 678 Night run A & B. Lamps Feb. 15, 82.

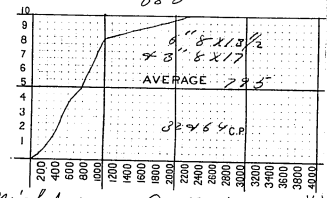


679 Three days working of lamps. T. Anderson worked in the morning way up to A. current & then full current suddenly & tube allowed to become solid and then worked off with dispatch.



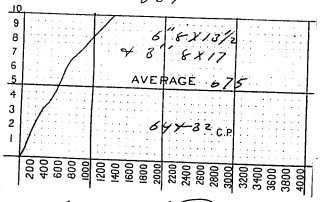
No 680 Day run A. & B. Lamps Feb. 16, 1882

680



681 Night run A & B Lamps Feb. 16, 1882.

681

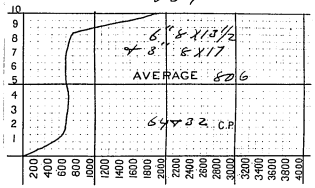


682 B. carbons of Feb 18 & 14 marked 11/7 B

683 B carbons of Feb 14 & 15 marked 13/11 B.

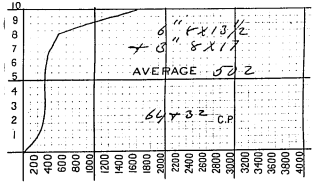
No 684 Day run A. & B. Lamps Feb. 17, 1882.

684



685. Night run A & B Lamps Feb. 11, 1882

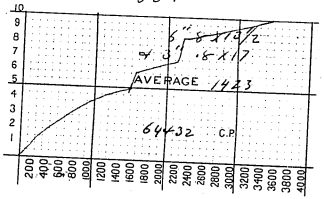
685



686 Fibres treated by Dr Haid. See 698 Feb 24th 1882.

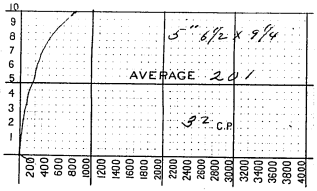
No 687. Day run A & B. lamps Feb 18, 1882.

687



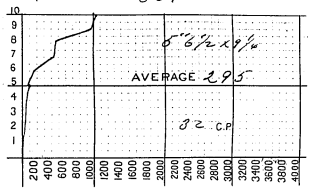
688 8 Candle A. Lamps 6 x 9 1/4 run of Feb 18, 1882.

688



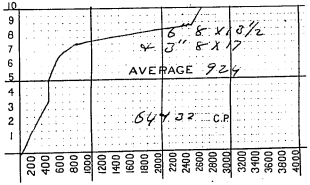
No 689. Day run A & B. Lamps Feb 20, 1882

689



690 Night run A & B Lamps Feb. 20, 1882.

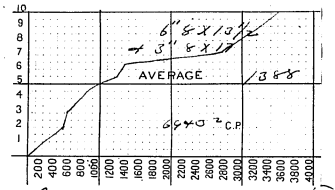
690



691 10 B carbons averaging 250 Ohms
692 10 B " " 115 "
693 B " of Feb 15 & 16 marked-
118
0

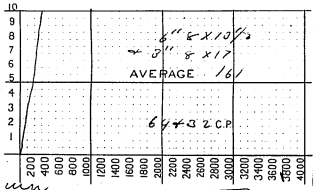
No 694 Day run A & B. Lamps Feb 21. 82.

694



695 Night run A & B Lamps Feb 21, 1882.

695

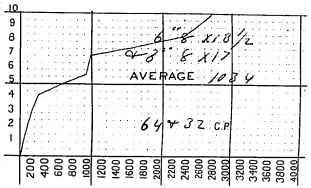


696 Day run A & B lamps Feb. 22, 1882.

Sheet

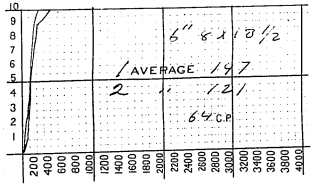
No 697 Night run A. & B. Lamps Feb. 22, 1882.

697



698 Carbons treated by Dr Haid Feb. 24, 1882.

698



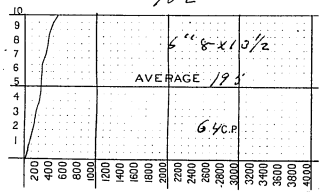
No 699 B. Carbons run of Feb 16 & 17th 1882
marked $\frac{97}{30}$.

700 B Carbons run of Feb 16 & 17. 1882
marked $\frac{112}{20}$

701 B Carbons run of Feb. 17 & 18, 1882.
marked $\frac{96}{40}$

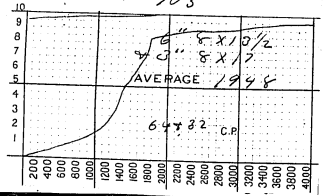
702 Lamps worked without putting in the last bea.

702



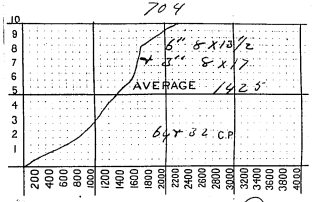
703 Day run. A & B lamps Feb 23, '82.

703



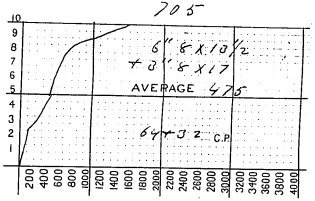
No 704 Night run A & B Lamps Feb 23, 1882.

704



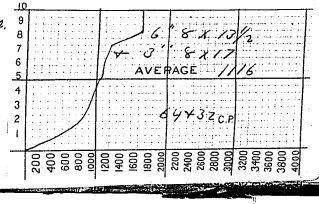
705 Day run. A & B. Lamps Feb 24. 1882.

705



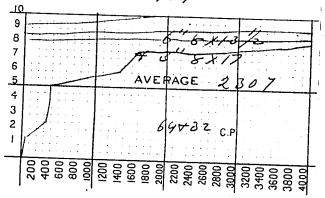
706 Night run
A & B Lamps Feb 24, 1882.

706



No 707 Day run A & B Lamps Feb 25, 1882.

707



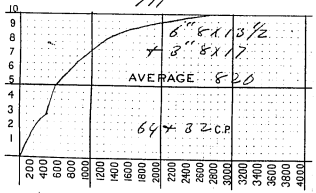
708 A. Carbons 4 in form Feb 28.

709 B " run of Feb 21, 1882 marked 91/30

710 B. Carbons run of Feb 21. 1882. marked 96/6-0

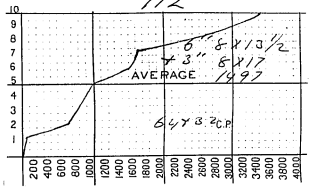
711 Day run A & B lamps Feb 24, 1882.

711



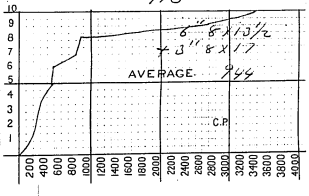
No 712 Night run A & B Lamps Feb. 27, 1882.

712



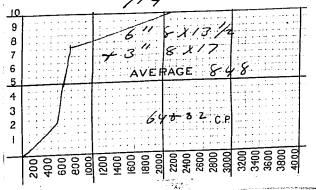
713 Day run A & B Lamps Feb 28, 1882.

713

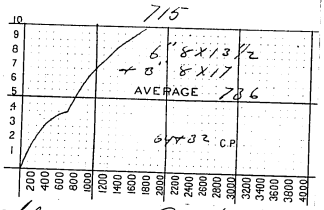


714 Night run A & B Lamps Feb 28, 1882.

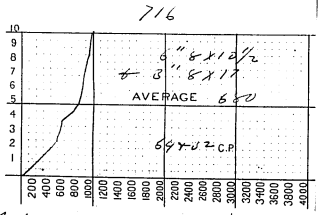
714



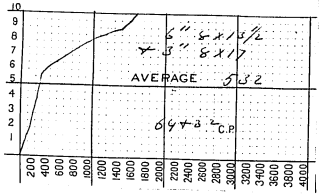
No. 715 - Day run A & B lamps March 1, 1882.



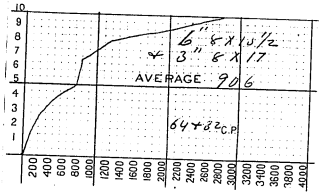
716 Night run A & B lamps Mch. 1, 82.



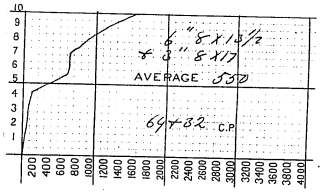
717 Day run A & B lamps March 2nd 1882.



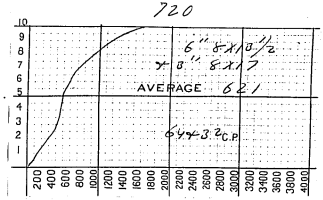
No. 718 Night run A & B Lamps March 2, 1882.



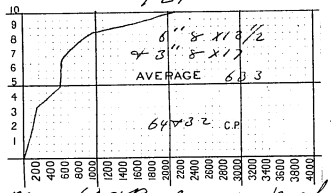
719 Day run A & B Lamps March 3, 1882.



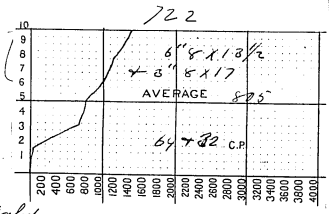
720 Night run A. & B. Lamps March 3, 1882.



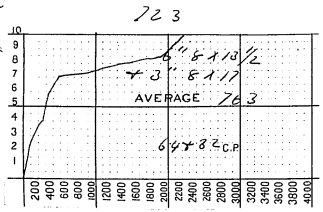
No 721 Day run A & B lamps Mch 4, 1882.



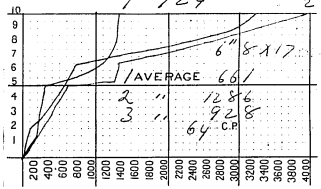
722 Day run A & B lamps Mch 6, 1882.



71. 723 Nightrun
A & B Lamps
7 March 6, 1882.



No 724 A & B carbons Lawsons run of the 6th inst March to be put up and tested Carbons 8 x 17



725 B. carbons of Feby 23, 1882 marked $\frac{74}{76}$

726 B carbons of Feb. 23, 1882. marked $\frac{75}{7}$

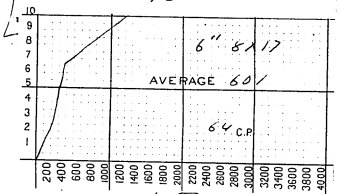
727 A carbons of Feb 22, 1882. marked H. R.

728 A carbons of Feb 24, 1882. marked $\frac{25}{90}$

729 B carbons of Feb. 25, 1882. marked $\frac{128}{100}$

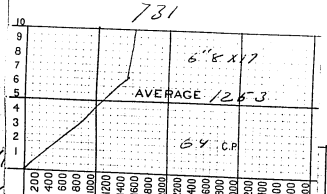
No 730 A carbons of Feb 27, 1882 marked 59/115

730



731 A Carbon of Feb 27, 1883 marked 47/0

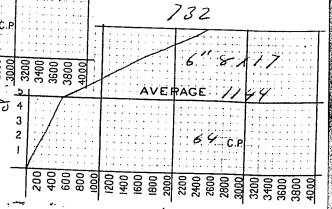
731



~~marked 7/120~~

732 A Carbons of Feb 28. 1882 marked 7/120

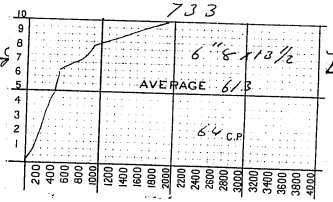
732



No 733 15 Lamps. A carbons Worked by monroe Danbury March 7, 1882. Brought up gradually and allowing Hall tubes to become solid at every move and on finishing giving full current until a change of color is noticed in bulb & then for final sealing.

733

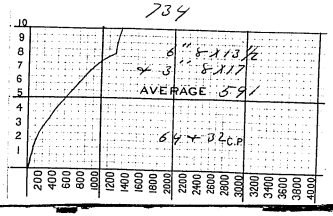
~~No 734~~



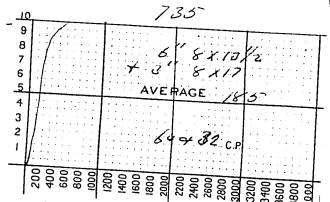
~~March 7, 1882~~

No 734 Day rim A & B Lamps March 7. 1882

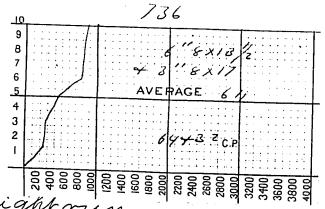
734



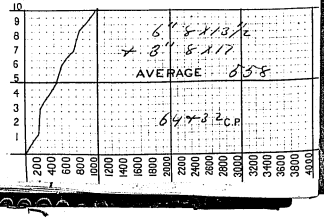
No 735 Nightrun A+B Lamps Mch 7, 1882.



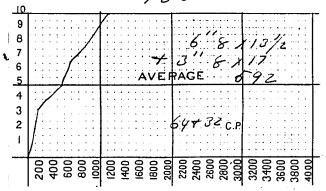
No 736 Day run A+B lamps March 8, 1882



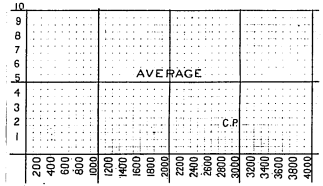
737 Nightrun A+B Lamps March 8, 1882



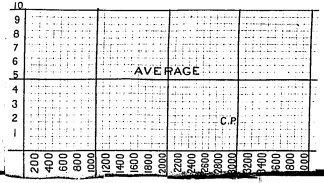
No 735 Nightrun A+B Lamps March 8, 1882.



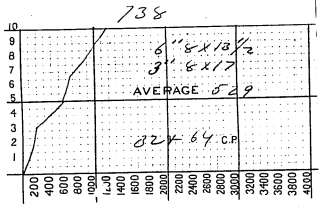
736 Day run A. + B lamps March 8, 1882



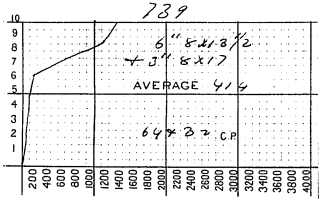
737 Nightrun ~~A+B Lamps March 8, 1882~~.
A+B Lamps
March 8, 1882



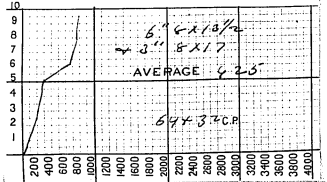
No 738 Day run A & B Lamps March 9, 1882.



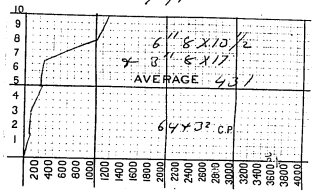
739 Night run A + B Lamp Mch 9, '82.



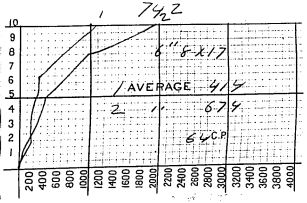
740 Day run ~~A + B Lamp~~ A + B Lamps March 10, 1882.



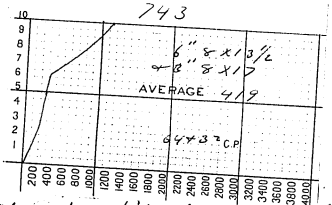
No 741 Night run A + B lamps March 10, 82



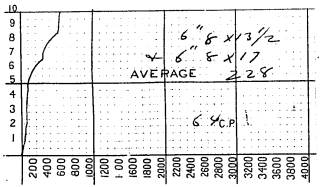
742 - Lamps exhausted on Large pumps worked in the ordinary way, worked off in 1. m. 15 manipulated by Prof Ayrton pumps numbered 10.11.12.13.14.15. Find pump's No 14 to give best results



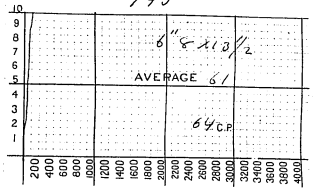
No. 743 Day run A & B Lamp Mar 11, 1882.



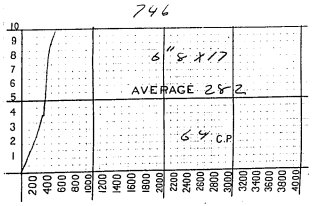
744 Lamps fifty burning 20 minutes on B current - after final inspection.



No. 745 A carbons run of March 1, 1882. marked 5.7 / 130

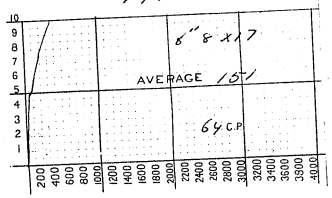


No. 746 A. carbons run of March 2, 1882. marked 44 / 60



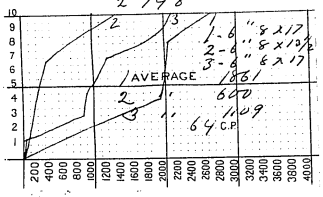
No 747 A Carbons run of March 4. 1882.
marked $\frac{35}{0}$

747



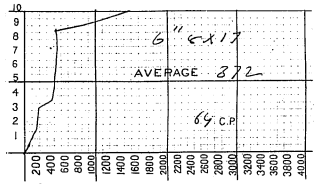
748 A. carbons run of March 4, 1882
marked $\frac{32}{190}$

2 748



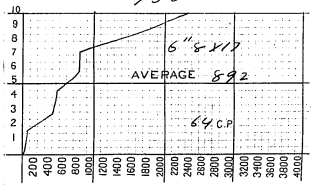
No. 749 A carbons run of March 7, 1882.
marked $\frac{31}{170}$

749

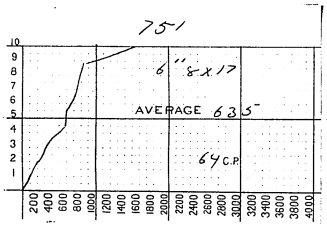


750 A. Carbons run of March 4, 1882
marked $\frac{37}{180}$

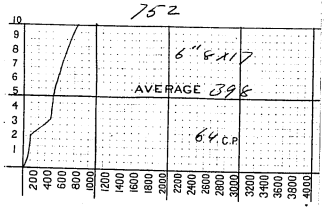
750



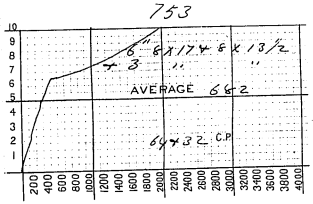
No
751 A. carbons run of Mch 6, 1882.
marked $\frac{16}{150}$



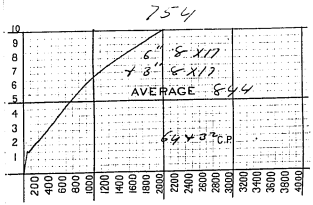
752 A. carbons run of March 7, 1882.
marked $\frac{49}{6}$



No
753 Day run A & B lamps March 13, 1882.

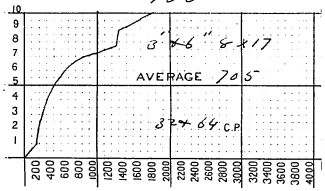


754 Night run A + B lamps March 13 1882.



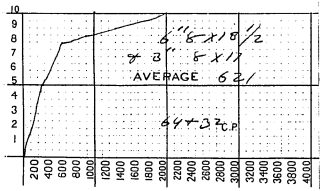
No 755 Day run A & B. lamps March 14, 82

755



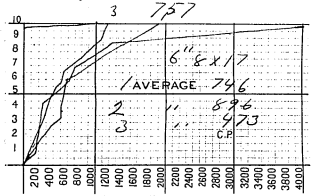
No 756 Night run. A & B lamps Mch 15, 1882.

756



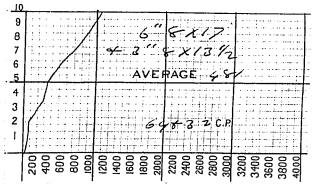
No 757 A Lamps worked on double pumps worked up to full current & allowed to burn at highest current for 15 minutes and sealed off.

757

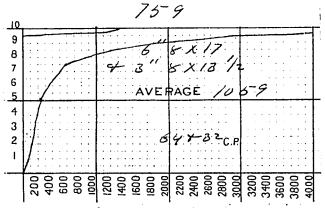


758 Day run A & B. Lamps March 15, 1882.

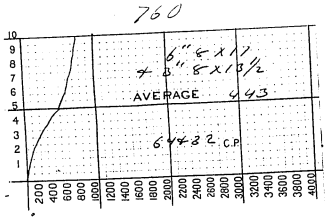
758



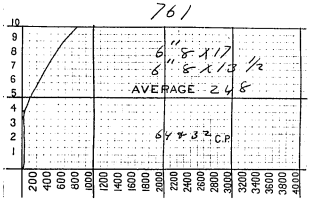
No 759 Night run A & B. Lamps March 15, 82.



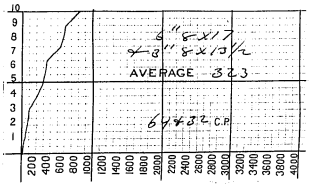
760 Day run A & B. Lamps March 16, 82.



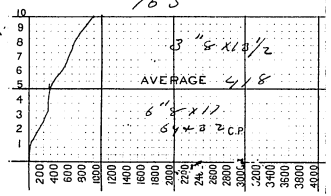
No 761 Night run A & B lamps March 16, 1882.



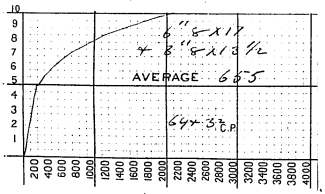
762 Day run A & B lamps March 17, 82.



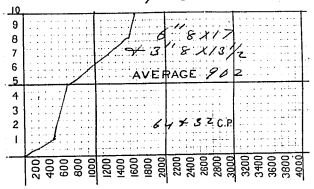
No 763 Night run A & B Lamps March 17, 1882.



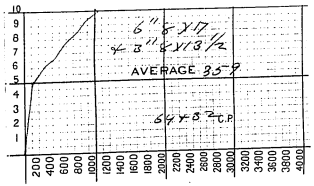
764 Day run A & B Lamps Mch 18, 1882.



No 765 Night run A & B Lamps Mch 20, 1882.



766 Day run A & B lamps March 20, 82.



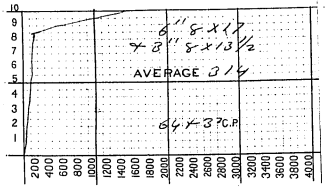
No 767 A. carbons run of March 8, 1882.
marked $\frac{17}{150}$

768 C. carbons - run of March 18, 1882
marked $\frac{49}{0}$

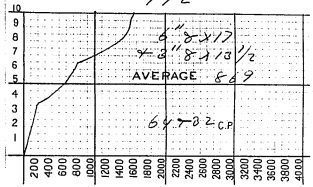
769 B. carbons - run of March 20, 1882.
marked $\frac{30}{\text{Spec.}}$

770 A. carbons - run of March 20, 1882
marked $\frac{24}{0}$

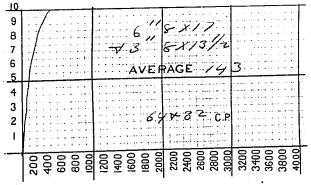
771 Day run A & B lamps Mch 21st 1882.



No 772 Night run A & B Lamps Mch 21, 1882.

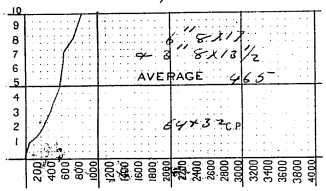


773 Day run A & B Lamps March 22, 1882.



No 774 night run A & B Lamps March 22, 1882.

774



775 1/4" fibres No 3 Stock

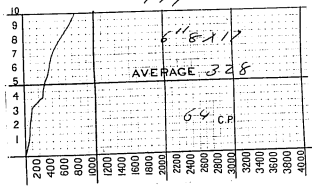
776 3/8" " 10 x 17 - D stock

777 15/16" " 10 x 17 D "

778 1 1/4" " 10 x 17 D "

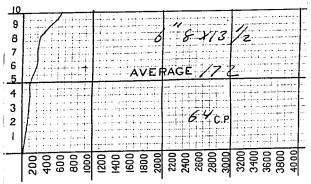
No 779 Lamps worked by Sawyer on #13 pump no current used on B except in switching, in A, use current low in A and run off regular and sealed with moderate high current.

779

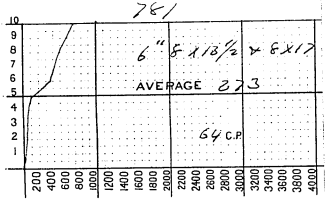


780 Lamps worked by Wm Voorhees on Pumps without P.H.L. those marked B. taken off with blue in bulb those marked T. with full current and no blue & those marked 1/2 T. sealed off no blue with 3 to cut out.

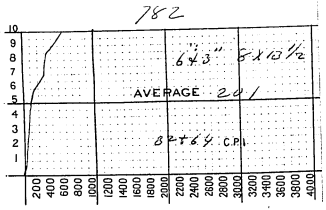
780



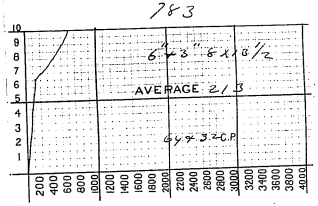
No 781 Lamps exhausted from Pumps no P. H. D. in the usual manner with current in and changing with solid tube



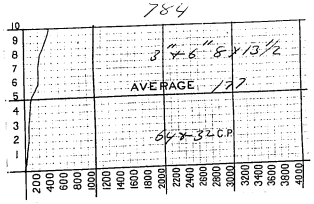
782 Day run A & B Lamps March 24, 1882.



No 783 Night run A & B. Lamps March 24, 1882.

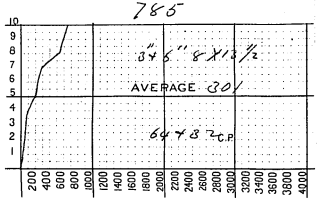


784 Day run A & B. Lamps March 25, 1882.



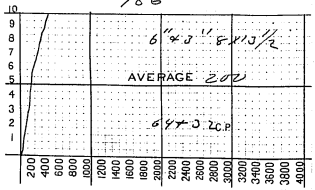
No 785 night run A & B Lamps March 27, 1882

785



786 Day run A & B. Lamps March 27, 1882

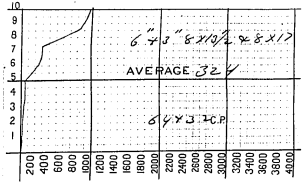
786



No 787 An experiment in A. Lamps 8 X 13 1/2 to ascertain the cause of carbon curling The manipulating will be as follows as soon as Vacuum is obtained in Bulb. The current put on at once with full Lamp resistance Box cut out & allowed to remain so until a solid tube is obtained & following the ordinary way & sealed off high current.

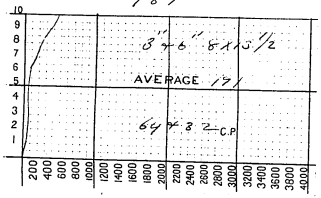
788 Day run A & B Lamps March 28, 82.

788



No
789 Night run A & B. Lamps March 28 1882

789



790 Three A Lamps 8 x 27 Immersed in Fu & Exhausted & sealed off high current one A Lamp 8 x 13 1/2

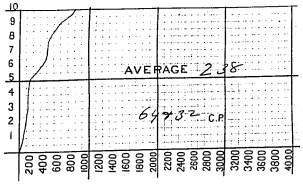
These lamps were set up at 12 8 candles on the last day of march being the last day that we ran at Menlo Park, - All three aged & averaged about 15 minutes.

No
791 Lamps with carbons soldered in clamps with soft solder.

[sheet]

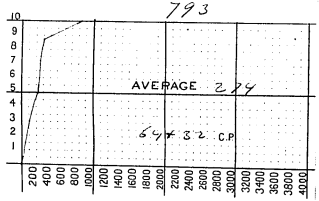
792 Day run A & B. Lamps March 29, 1882.

792



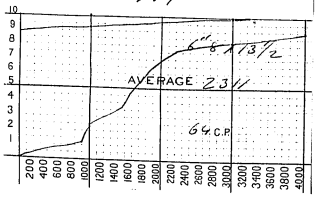
No
793 Night run A. & B Lamps March 29 82.
This was the last order of lamps set up at menlo Park.

793



Harrison N.J.
June 9, 1882
794 Lamps sealed off with a bulb attached containing P_2O_5 which was left attached to the lamp 2 months when it was sealed off.

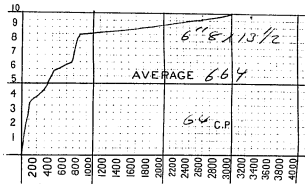
794



No
795 Lamps sealed off with a bulb attached containing P_2O_5 + Na Cl. which was left attached to lamp two months when it was sealed off. June 9, 1882.

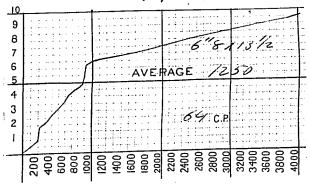
796. Day run a Lamps June 13, 1882.

796

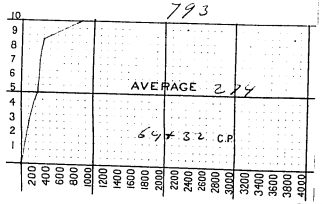


797 Night run A Lamps June 13, 18

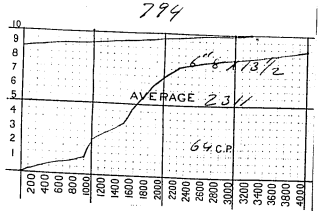
797



No
793 Night run A. & B Lamps March 29/82.
This was the last order of lamps set up at Menlo Park.

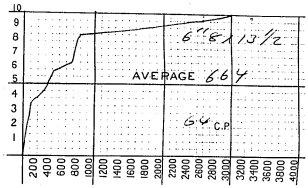


Harrison N.J.
June 9, 1882
794 Lamps sealed off with a bulb attached containing P_2O_5 which was left attached to the lamp 2 months when it was sealed off.

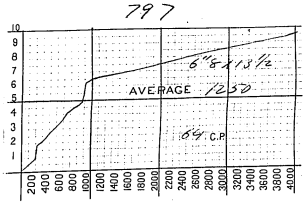


No
795 Lamps sealed off with a bulb attached containing P_2O_5 + Na Cl. which was left attached to lamp two months when it was sealed off. June 9, 1882.

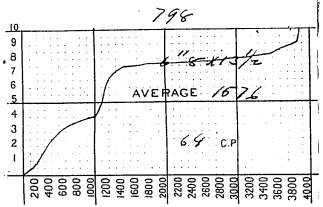
796 Day run A Lamps June 13, 1882.



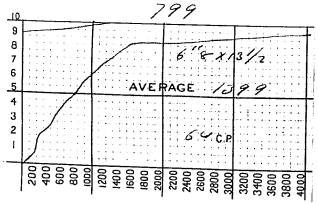
797 Night run A Lamps June 13, 1882.



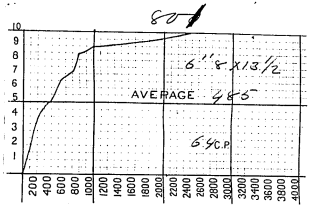
No 798 Day run A Lamps June 14, 1882.



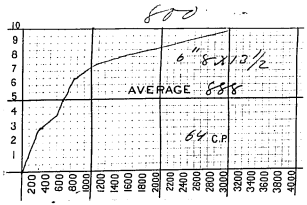
799 Night run A Lamps June 14, 1882.



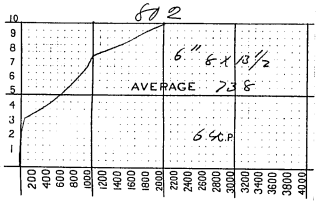
No 800 Day run A Lamps June 15, 1882.



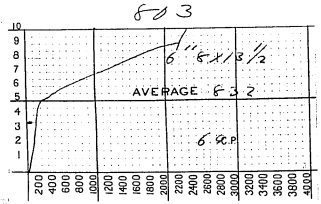
801 Night run A Lamps June 15, 1882.



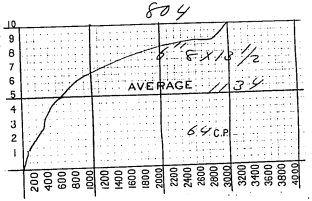
200
802 Day run A Lamps June 16, 1882.



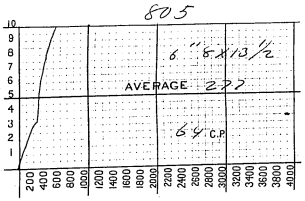
803 Night run A Lamps June 16, 82.



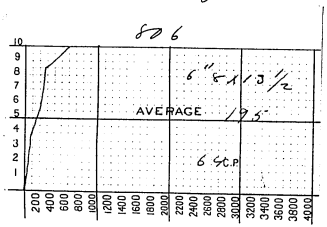
200
804 Day run A Lamps June 17, 1882.



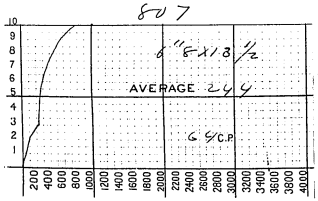
805 Day run A Lamps June 19, 1882.



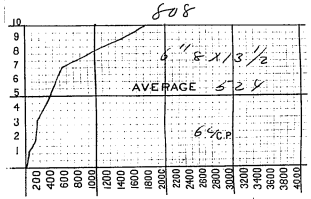
No 806 Night run A Lampa June 19, 1882.



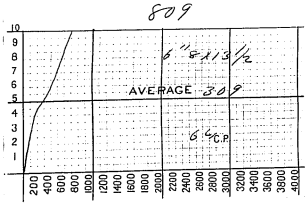
807 Day run A Lampa June 20, 1882.



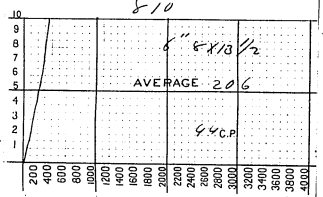
No 808 Night run A Lampa June 20, 1882



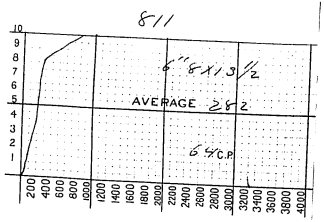
809 Fibres carbonized two in a form



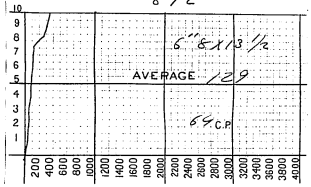
No 810 Dayrun A Lamps June 21, 1882.



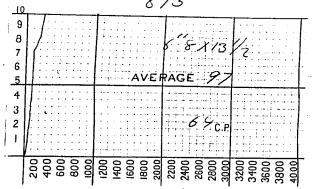
811 Night run A Lamps June 21. 1882.



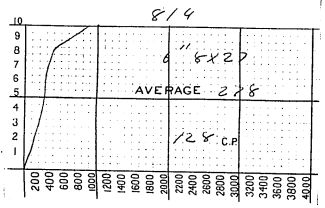
No 812 Day run A Lamps June 22. 1882.



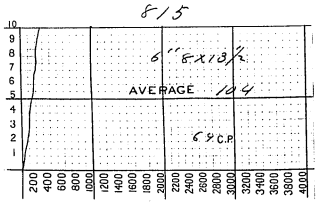
813 Night run A. Lamps June 22. 1882.



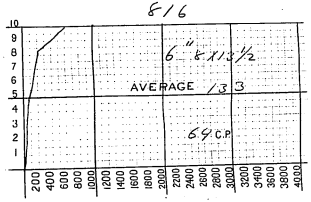
No 814 8 X 27 A Lamps June 22, 1882.



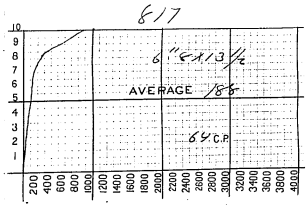
815 Day run A Lamps June 23, 1882.



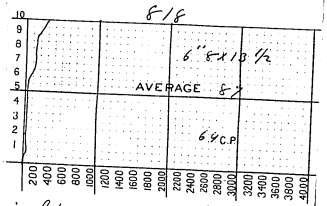
No 816 Night run A Lamps June 25, 1882.



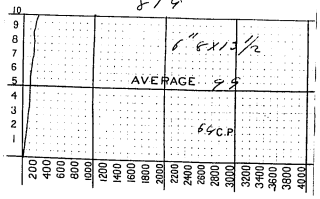
817 Day run A Lamps June 24, 1882.



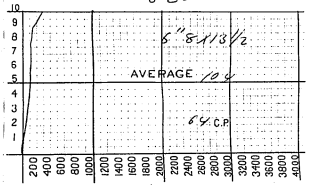
No 818 Day run A Lamps June 26, 1882.



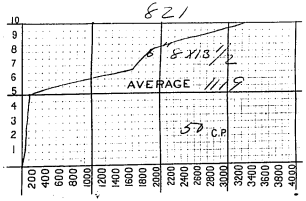
819 Night run A Lamps June 26, 1882.



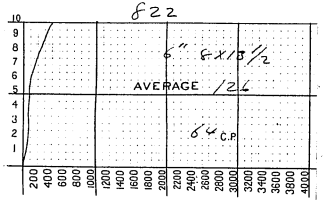
No 820 Lamps dried with P_2O_5 June 26, 82



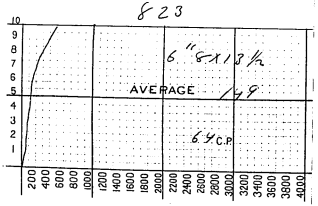
821



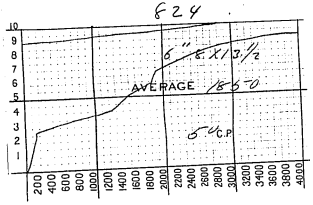
No 822 Day run A. lamps June 27, 1882.



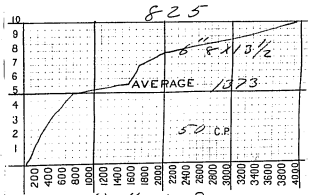
823 Night run A Lamps June 27, 1882.



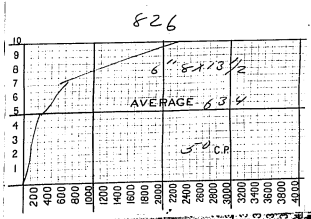
No 824



825

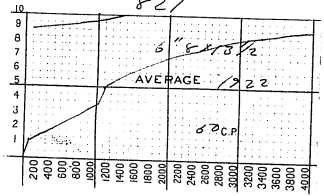


826 Day run A Lamps June 28, 1882

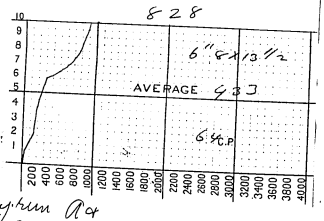


No 827 Night run A lamps June 28, 1882.

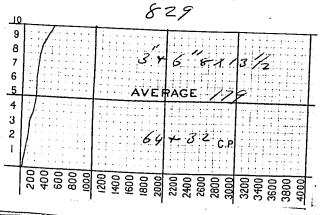
827



828

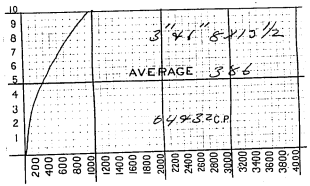


829 Day run A & B lamps June 29 1882.

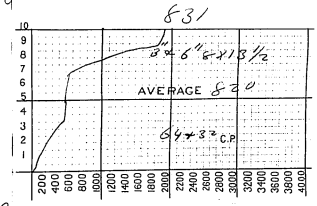


No 830 Night run A & B lamps June 29, 1882.

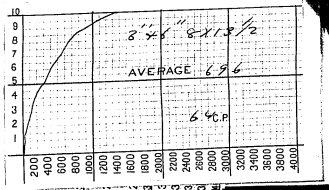
830



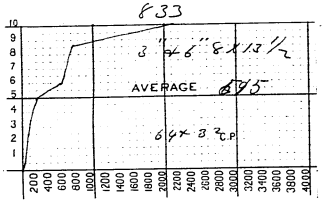
831 Day run A & B. Lamps June 30, 1882.



832 Night run A & B lamps June 30 1882.



833 no Day run A&B. lamps July 1. 1882.



834 –

835 –

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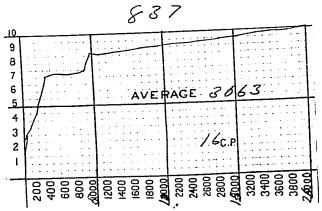
837 –



838 –

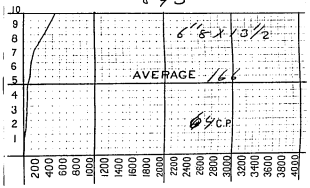
839 no –

840 –

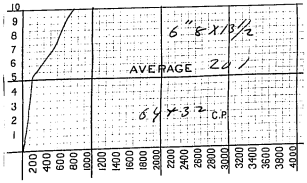
841 –

842 –

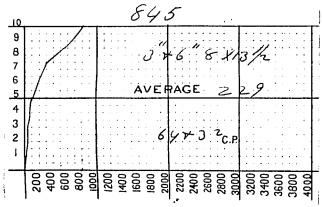
843 – Carbons treated with glycerin



844 – Day run A&B lamps July 3. 1882

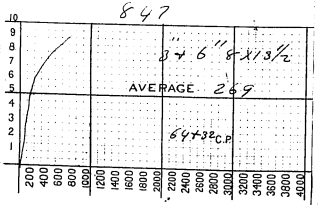


No. 845 - Night run A & B lamps July 5, 1882.

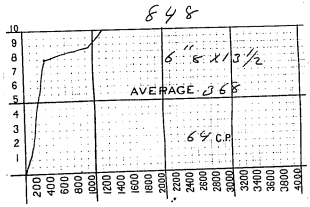


846 —

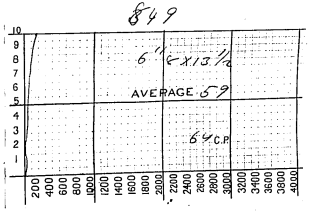
847 Day run A & B lamps July 5, 1882.



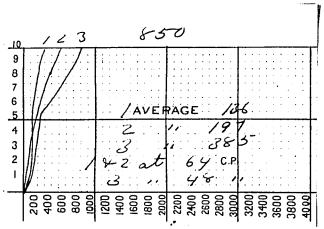
No. 848 - Night run A & B lamps July 5, 1882.



849 —

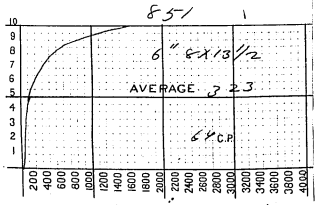


No 850 -

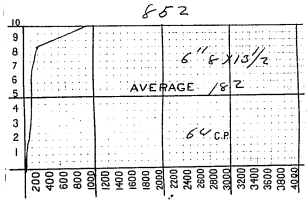


Make 25 regular 6" 8 X 13½ lamps with Ca Cl₂ in them. Set to one side for 5 days or more. Test half with Ca Cl₂ on & half with Ca Cl₂ sealed off. July 8, 1882.

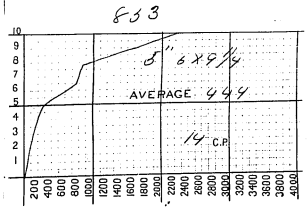
851 - Run 15 lamps from pumps containing new Ca Cl₂. new style pumps July 8, 1882.



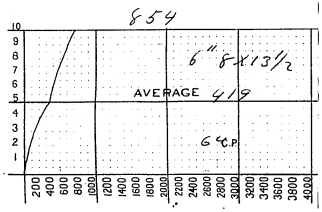
No 852. Run 15 lamps from pumps containing old Ca Cl₂ with bubbles in it new style of pumps July 8, 1882



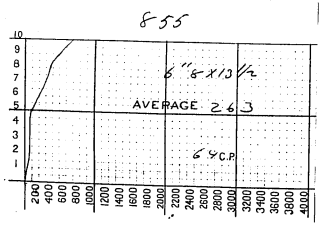
853 10 Lamps 6 x 9½ carbons.



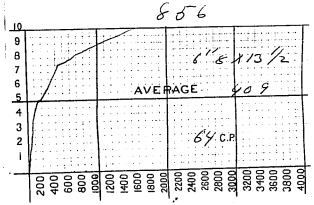
No 854 Day run a Lamps July 6, 1882.



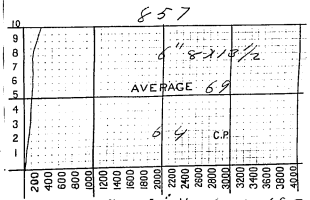
855 Night run a Lamps July 6, 1882.



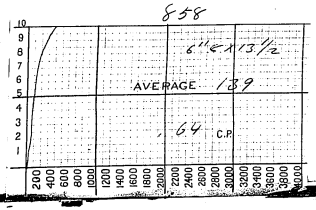
856 -



857 Day run a Lamps July 7, 1882



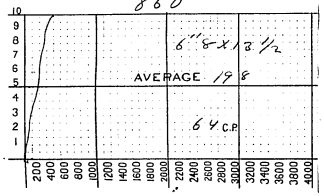
858 - Night run A Lamps July 7, 1882



859 —

860 —

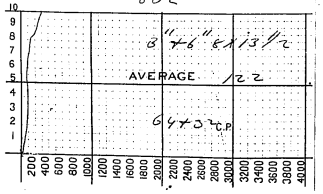
860



861 —

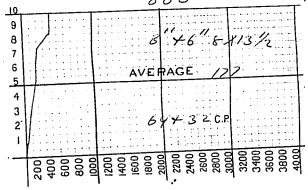
862 Day run a & B lamp July 8, 1882.

862



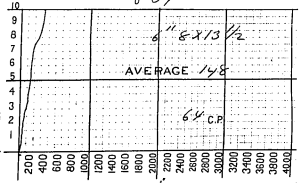
No 863 Night run a & B lamps July 8, 1882.

863

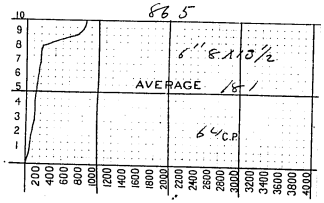


864 Day run a lamps July 10, 1882.

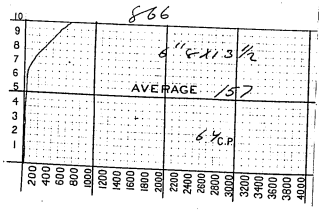
864



No 865 - Night run A Lamp July 10, 1882

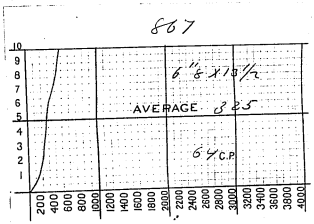


866 -



Carbons laid in alum water for 24 hours July 10, 1882.

No 867 -



Lamps run off without heating on heater July 11, 1882.

868 -

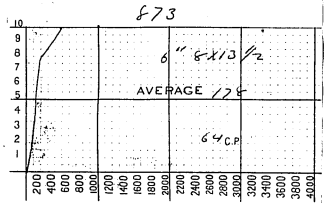
869 -

870 -

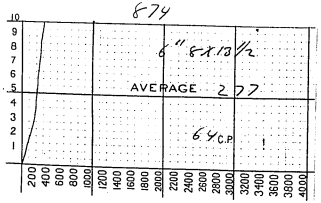
871 -

872 -

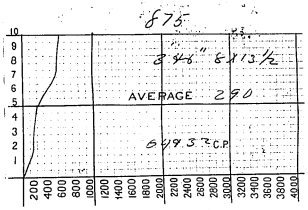
No 873 1st shift a Lamps July 11, 1882.



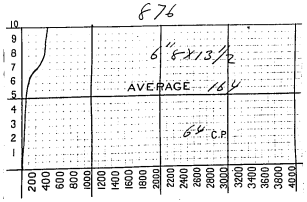
874 2nd shift a lamps July 11, 1882.



No. 875 3rd Shift July 11, 1882 a. 13 Lamps

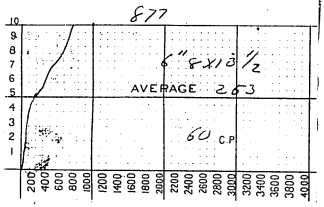


876 -



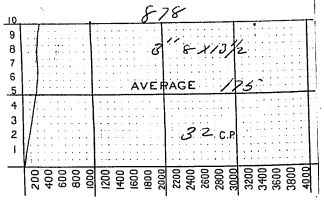
Fibres soaked in alum water July 12, 1882.

No 877 -

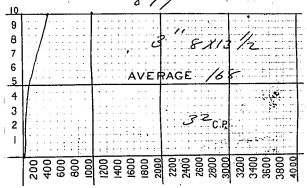


Lamps made from carbons without shanks. to test quality of carbon.
July 12, 1882.

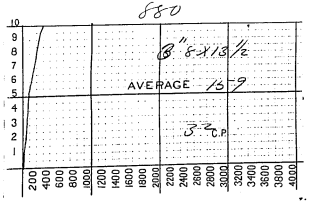
878 - 1st Shift B lamps July 12, 1882.



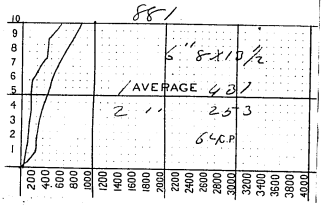
No 879 - 2nd Shift B Lamps July 12, 1882.



880 3rd Shift B Lamps July 12, 1882.

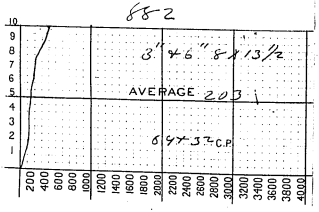


No 881 –

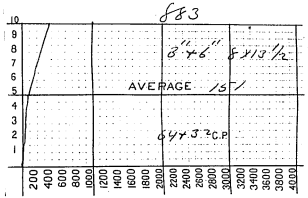


Lamp run through without drying on pumps July 12, 1882.

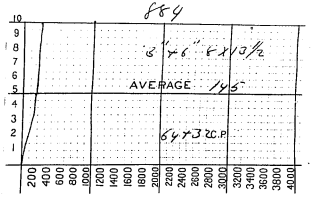
882 1st shift A & B lamps July 13, 1882.



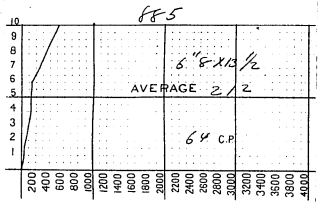
No 883 2nd shift A & B lamps July 13, 1882.



884 – 3rd Shift A & B lamps July 13, 1882.

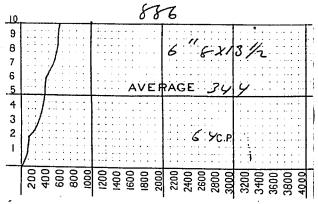


No 885 – —



Lamps run off without blue on clamps & dense blue in bulb.

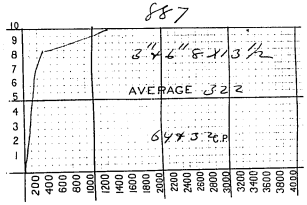
886 –



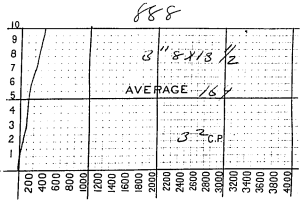
July 12, 1882

Lamps run off without blue on clamps and light blue in bulbs.

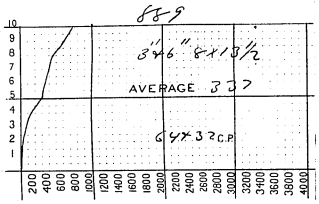
No 887 – 1st Shift A & B Lamps July 14, 1882.



888 – 2nd " Shift B. lamps July 14, 1882.

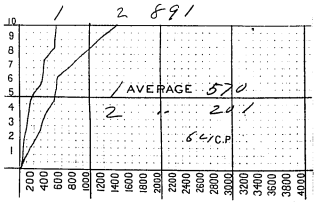


No 889 - 3rd shift A & B lamps July 14, 1882.



896 - Fibres ran through in old forms July 12, 1882.

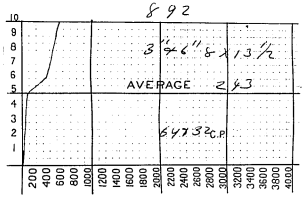
891 -



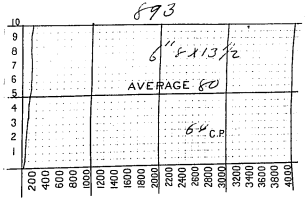
Fibres ran through forms with selected side weights

July 12, 1882.

No 892 1st shift A & B Lamps July 15, 1882.



893 -



July 15, 1882.

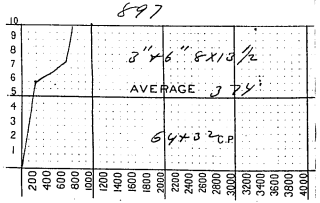
Lamps run off with rubber stopper on stem of Lamp; not using all entire on stem of Lamp, or rubber tube used as stopper. Use mercury as a positive seal.

No 894 Twenty five lamps with $Ca\,Cl_2$ on tube and bulb to be exhausted & no current used & $Ca\,Cl_2$ left on lamps 24 hours.

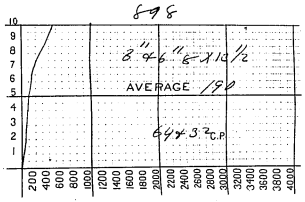
895 Fifteen lamps with $Ca\,Cl_2$ on tube & bulb to be exhausted & only low current used in both resistance & sealed off with $Ca\,Cl_2$ left on 24 hours.

896 - Same as 895 - worked on the 100 Volt line.

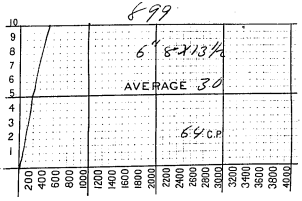
897 1st Shift A+B. July 17, 1882.



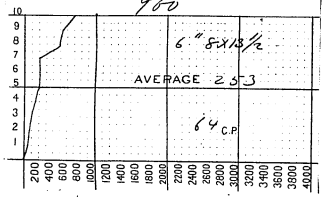
No 898 2nd " Shift A+B. July 17, 1882.



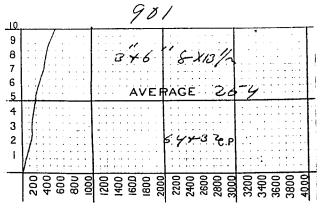
899 3rd " Shift A Lamps July 17, 1882.



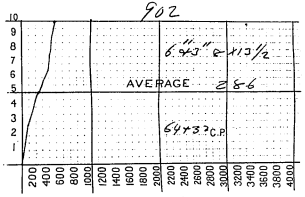
No 900 – Same as 881 July 17, 1882.



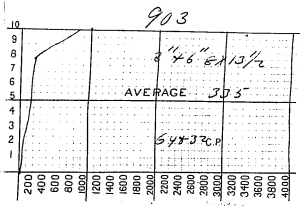
901 1st shift A & B lamps July 18, 1882



No 902 2nd shift A & B. lamps July 18, 1882.

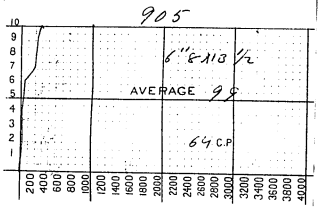


903 – 3rd Shift A & B lamps July 18, 1882.



904 – Lamps run off without drying or heating. July 17, 1882.

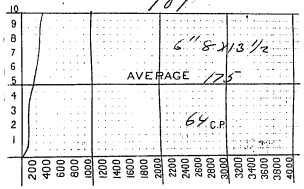
no 905 –



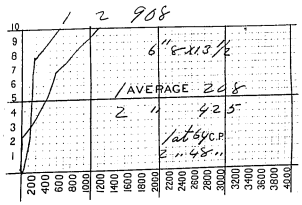
Carbons spotted – extra spots.
July 17, 1882.

906 Lamps run off with blue worked off the clamps & sealed off without reference to condition of column of Hg in pump.
July 20, 1882.

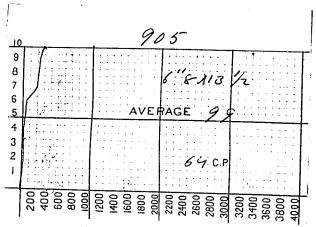
no. 907 Regular lamps to be set aside for four weeks
July 17, 1882.



no 908 – 1st shift A Lamps July 19, 1882.



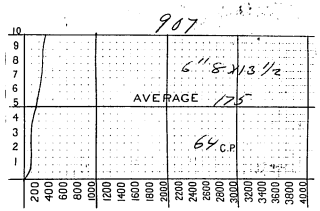
no 905 -



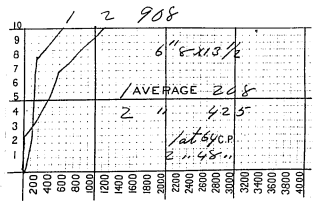
Carbons spotted - extra spots.
July 17, 1882.

906 Lamps run off with blue worked off the clamps & sealed off without reference to condition of column of Hg in pump.
July 20, 1882.

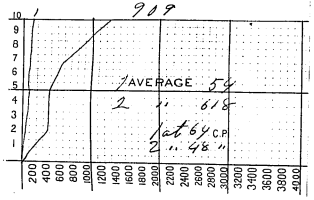
no. 907 Regular lamps to be set aside for four weeks
July 17, 1882.



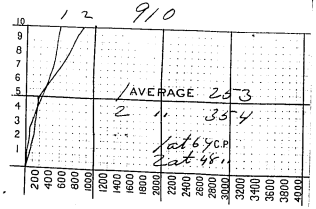
no 908 - 1st shift A Lamps July 19, 1882.



No 909 - 2nd shift A. Lamps July 19, 1882.

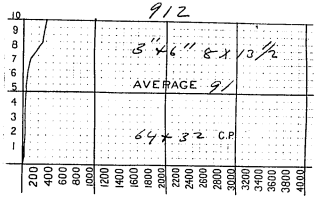


910 - 3rd shift A Lamps July 19, 1882

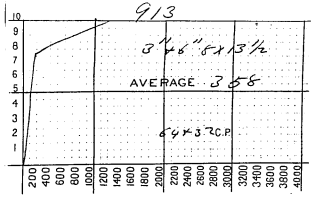


911 Lamps run off with dense blue in bulb & high sealing off with blue worked off Lamps ~~[illegible]~~ column of Hg. in the pump July 20, 1882

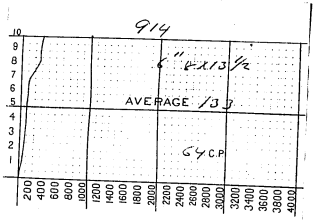
No 912 Day run A+B Lamps July 20, 1882.



913 Night run A+B Lamps July 20, 1882.



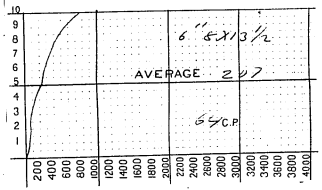
No 914 –



Lamps worked regularly not allowing tube to become fair or solid – then burning carbon high allowing tube to become solid with high burning & sealed off high.

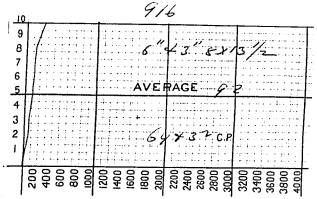
July 20, 1882.

No 915 –

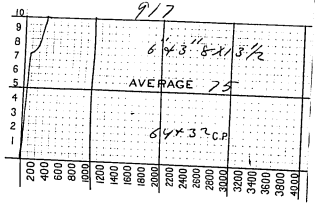


Lamps run quickly – blue worked out off lamps – sealed off with middle of spool 82 boy 2 ~~ds~~ current July 20, 1882.

916 Day run A & B lamps July 21, 1882.

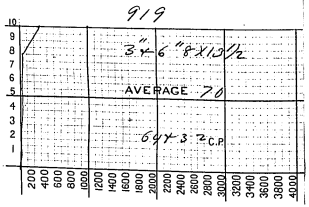


No 917 Night run A+B lamps July 21, 1882.

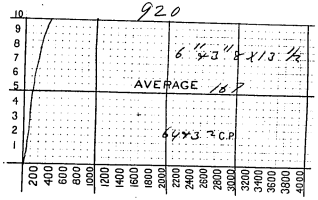


918 – Lawsons extra weighed fibres July 20, 1882.

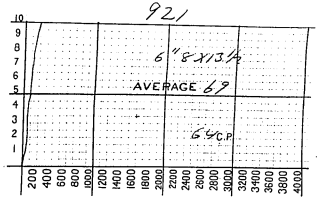
919 Day run A+B. July 22, 1882.



No 920 Night run A+B. Lamps July 22, 1882.

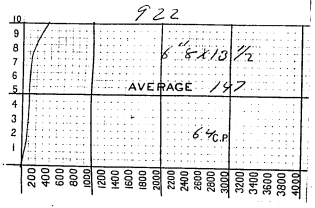


921 –

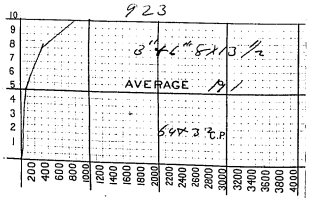


Upton's order July 20, 1882.

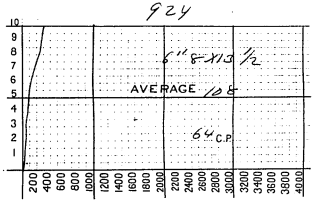
No. 922 Night run A Lamp. July 24, 1882.



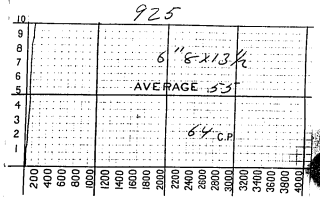
923 - Day run A. & B. Lamp. July 24, 1882



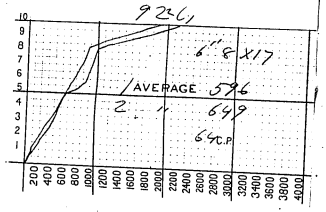
No 924 Day run A. Lamps July 25, 1882.



925 Night run A. Lamps July 25, 1882.

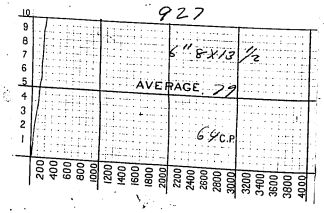


No 926 July 20, 1882.

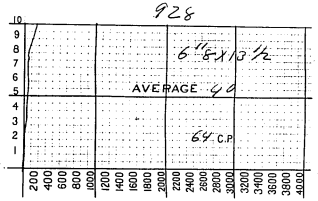


Edison's experiment - carbons placed in kerosene oil for 30 minutes.

927 Day run A Lamps July 26, 1882.

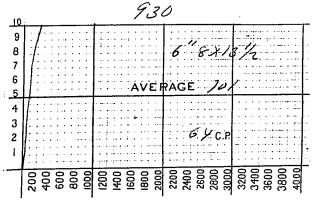


No 928 Nightrun A. Lamps July 26, 1882.



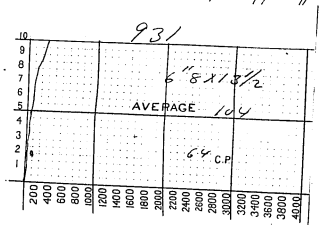
929 Weighed carbons July 27, 1882.

930 July 27, 1882.

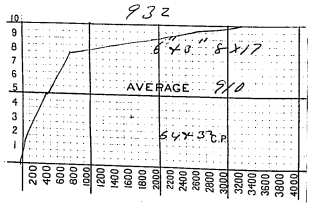


Increase in wasting bulbs.

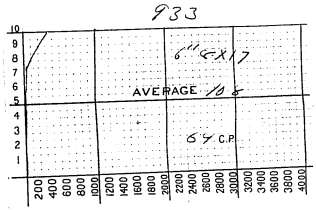
No 931 Day run A + B lamps July 27, 1882.



932 - Night run A. + B. lamps July 27, 1882.



No 933 —



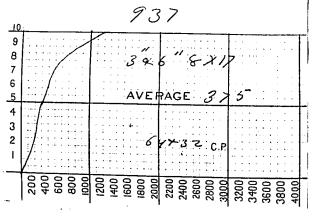
Carbons soaked in distilled water for 5 minutes & then immersed in boiling distilled water with 50 grms of salt to the qt.
July 27, 1882.

934 - Lamp bulbs soaked in hot water with 30 grains of salt to the qt.
July 27, 1882.

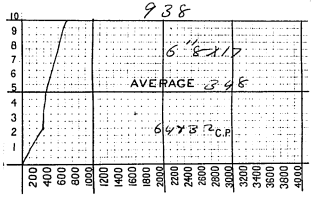
No 935 - Bulbs washed in hot water with 40 grains of salt to the qt. July 27, 1882.

936 Bulbs washed in hot water with 50 grains of water to the qt. July 27, 1882.

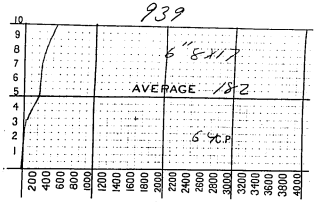
937 - Day run A. lamps July 28, 1882.



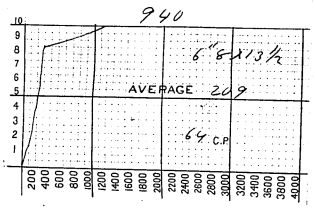
No 938 Night run A & B lamps July 28, 1882.



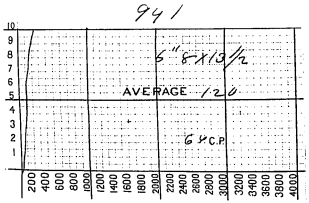
939 Day run A & B lamps July 29, 1882.



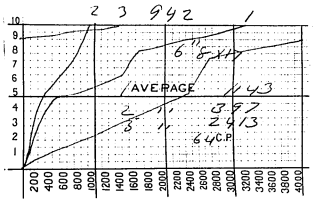
No 940 – Fibres dipped in collodion, July 31, 1882



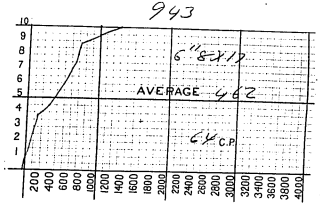
941 Carbons dipped in collodion July 31, 1882



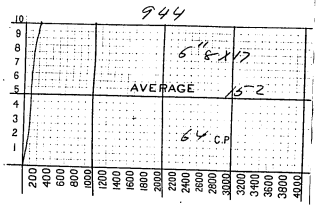
No. 942. Carbons from carbon forms.



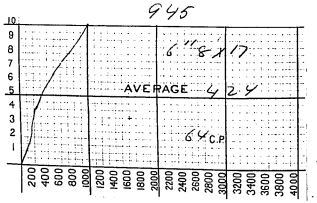
943 Day run A & B. Lamps July 31, 1882.



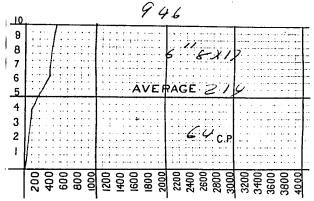
No 944 Night run A. Lamps July 31, 1882.



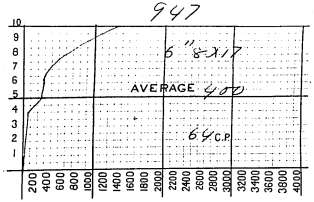
945 Day run A Lamps Aug 1, 1882.



No. 946 Night run A. Lamps Aug 1, 1882.

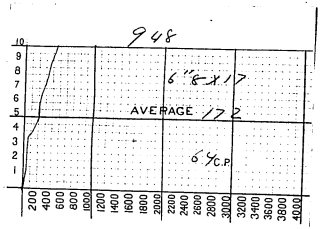


947 -



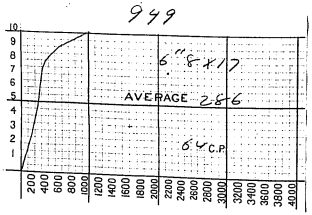
Fibres immersed in coal oil for 24 hours Aug 1, 1882.

No 948 -

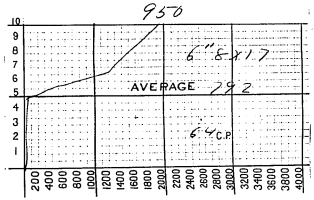


Fibres immersed in collodion & then boiled & allowed to remain 20 hrs.
Aug 1, 1882.

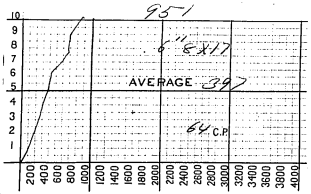
949 Day run A. Lamps Aug 2, 1882.



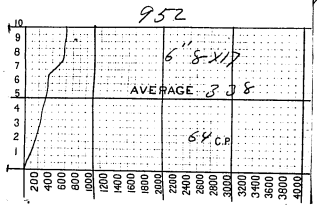
No 950 Night run A lamps Aug 2, 1882.



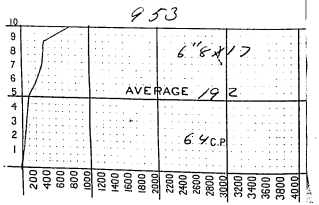
951 Day run A. Lamps Aug 3, 1882.



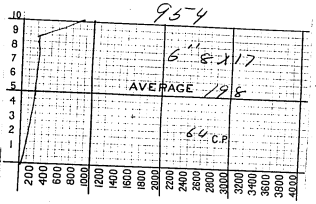
No. 95-2. Night run A. lamps Aug 3, 1882.



95-3 - Fibres carbonized 2 in a form in carbon forms Aug 3, 1882.

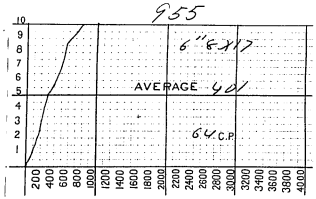


No 95-4 Aug 3, 1882.



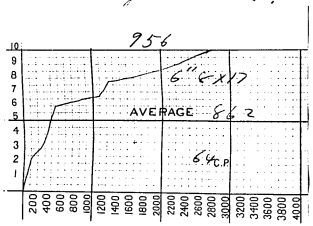
Fibres dipped in kerosene when hot

95-5 -



Carbons dipped in kerosene containing 15 grains terchloride Aug 3, 1882. Nickle forms.

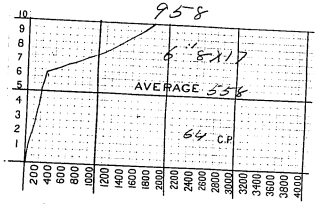
No 956 carbonize with carbon forms double mould & pass chlorine through until about 100° & 4 hrs. then throw carbons in kerosene with terchloride carbon Aug. 3, 1882.



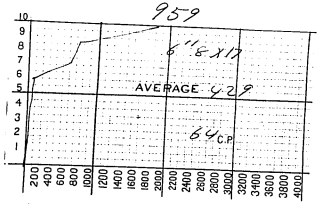
2'153hrs

957 Fibres soaked 24 hours in cold collodion Aug 3, 1882.

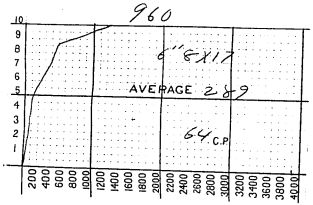
No 958 - Day run a Lamps Aug 4, 1882.



959 Night run a. Lamps Aug 4, 1882.

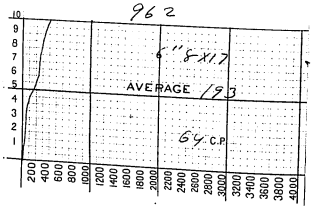


No 960 Day run A Lamps Aug 5, 1882.

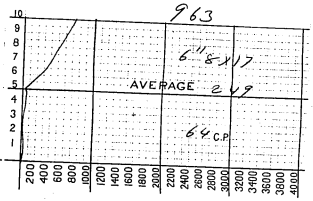


961 –

962 Day run A Lamps Aug 9, 1882.



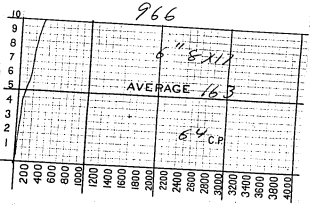
No 963 Night run A Lamps Aug 7, 1882.



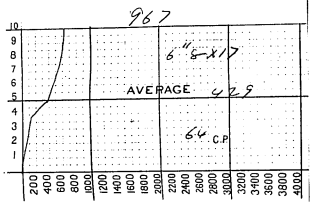
964 Fibres taken from carbon forms Aug 8, 1882.

965 Fibres taken from carbon forms forms immersed in kerosene oil & 15 grams of terchloride. Aug 8, 1882

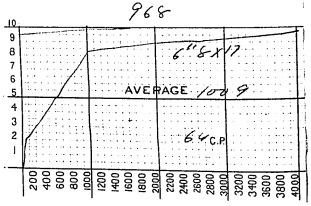
966 Day run A. lamps Aug 8, 1882.



No 967 Night-run A. Lamps Aug 8, 1882.



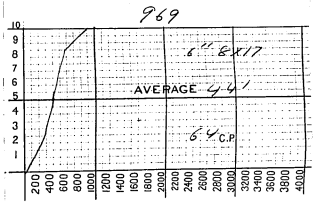
968 Carbons run through in carbon forms with double moulds & covers Aug 9, 1882.



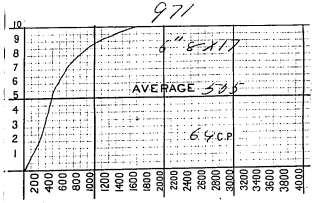
Aug 9, 1882.

No 969 Lamps with carbons immersed in Kerosene oil + $CaCl_2$ bottle in side of stem & allowed to remain after exhausting with $CaCl_2$ bottle full two months & then tested

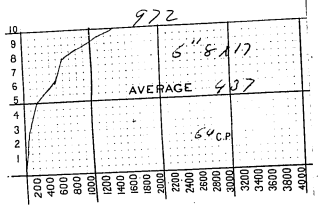
970 - Day run A. Lamps Aug 9, 1882.



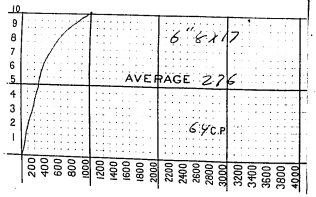
971 - Night-run A. Lamps Aug 9, 1882.



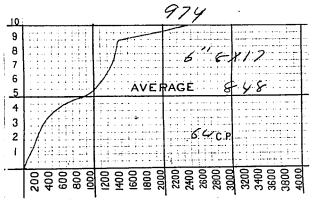
No 972 Day run A. Lamps Aug 10. 1882.



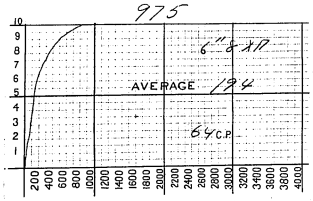
973 Night run A. Lamps Aug 10, 1882.



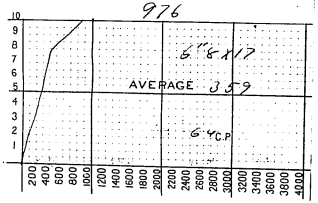
No 974 - Fibres carbonized in carbon forms whilst baking forms. Aug 9, 1882.



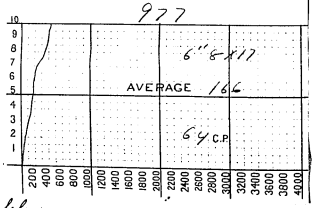
975 Carbons taken from nickel forms forms immersed in kerosene oil for 3 hours. Aug 10, 1882.



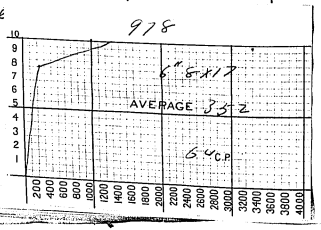
No 976 Day run A lamps Aug 11, 1882.



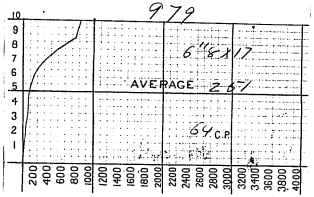
977 Night run A Lamps Aug 11, 1882.



978-Dense blue in bulbs Aug 10, 1882.

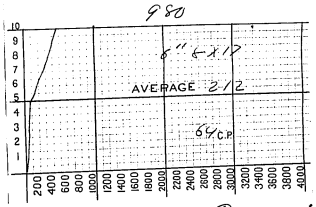


No 979- Aug 10, 1882



Carbons double cover nickel forms.

980 Day run A Lamps Aug 12, 1882.



981- Carbon forms double cover. Aug 10, 1882.

Charles Batchelor Notebook, Cat. 1303

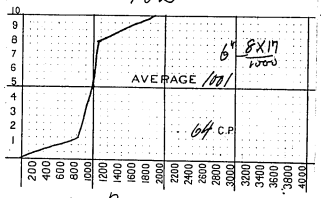
This notebook covers the period August-October 1882. All of the entries are by John W. Howell. The book contains notes and graphs of electric lamp experiments, which are numbered 982 through 1301. The spine is labeled "Expt 982-1301." The cover is marked "3." There are approximately 130 unnumbered pages.

No 982 C aug 10, 1882.

982 Carbon forms double cover

982

2502 hours –

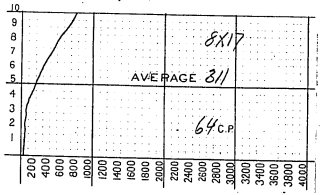


983 Carbon forms double cover B. Aug 10, 1882

984 Day run a lamps Aug 14, 1882.

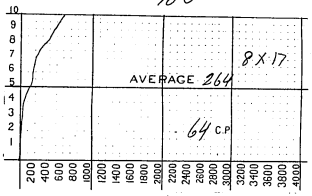
984

777 hours



No 985 Night runs A. lamp Aug 14, 1882.

985



986 Weighed carbons Aug 15, 1882.

987 " " " 15, 1882.

988 " " " 15, 1882.

989 " " " 15, 1882.

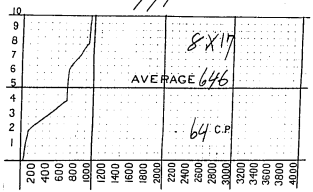
990 " " " 15, 1882.

991 J Aug 15, 1882.

Regular nickel forms.

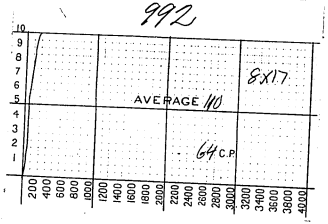
991

1615 hours –



No 992 Regular C nickle formk. Aug 15. 1882.

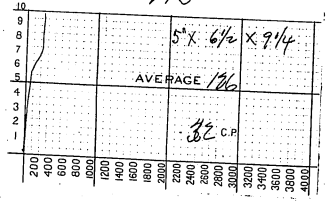
992



993 Regular B nickle forms Aug 15, 1882.

1 Sheet

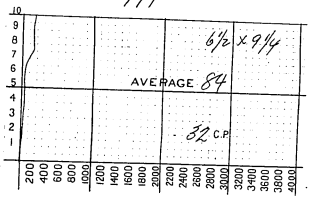
993



No. 994 5" inch 6½ X 9¼ Aug 16, 1882.

Forms immersed in kerosene oil with standard solution 1 oz terchloride to one gallon of kerosene oil, Carbons not immersed.

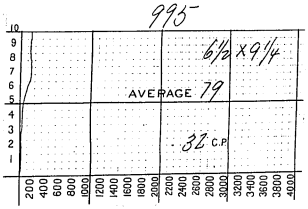
994



995 5 in. fibres 6½ X 9¼ Aug 16, 1882.

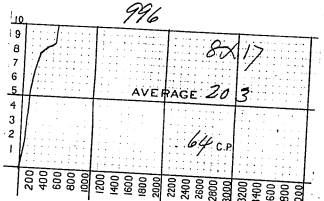
Carbonized in regular carbon forms

995



No 996 Carbons from carbon forms Aug 16, 1882.

996



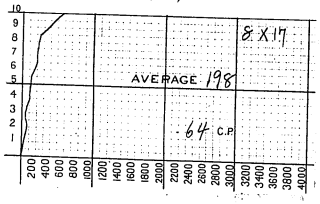
508 hr.

marked E. H.

997 Day run A. Lamps Aug 15, 1882

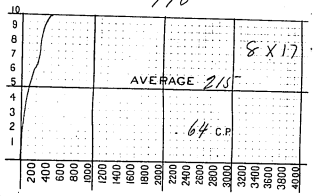
Sheet

997



No 998 Night run A. Lamps Aug 15, 1882.

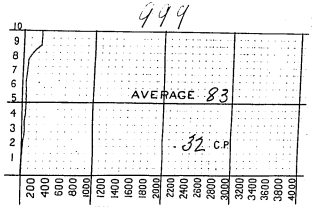
998



999 - Fibres placed in furnace at low heat on tin plate and dried so as to remove moisture Aug 17, 1882.

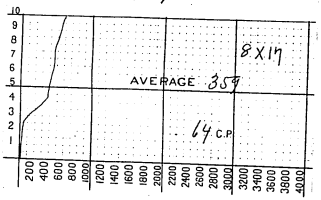
1000 - 5" 6½ X 9¼ Fibres run through in carbon forms in double covers - carbons immersed in standard oil. Aug 17, 1882.

999



No: 1000 Day run Aug 16, 1882. A Lamps

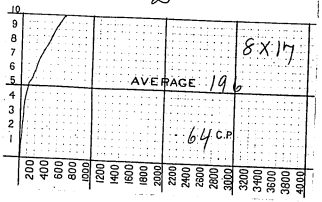
1



2 – Night run A. Lamps Aug 16, 1882.

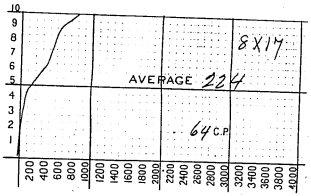
Sheet

2



No 3 Day run A Lamps Aug 17, 1882.

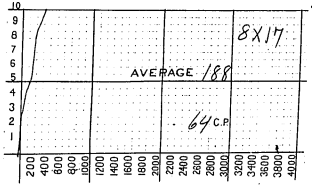
3



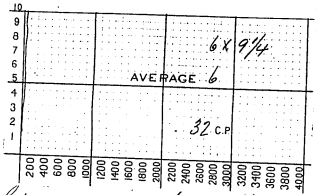
4 Night run A Lamps Aug 17, 1882.

Sheet

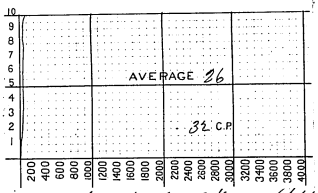
4



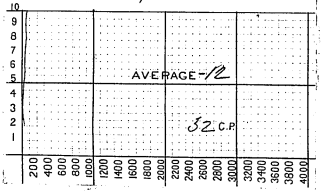
No 5 Day run A. Lamps 6 x 9¼ Aug 18, 1882.



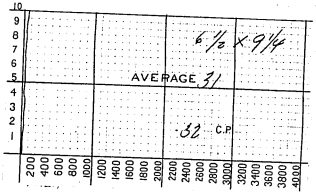
6 Night run 6 x 9¼ Aug 18, 1882.



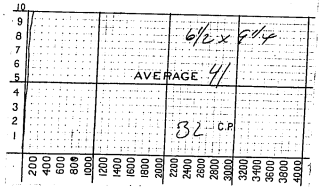
7 Day run A. Lamps 6 x 9¼ Aug 19, 1882.



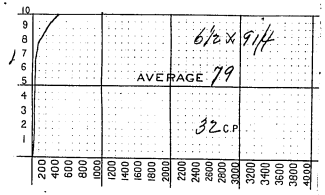
No 8 10 candle lamps put up Aug 22, 1882 to 32. P.H.D. left on side of lamps for three (3) weeks and then sealed off.



9 Day run A Lamps Aug 21, 1882
6½ x 9¼



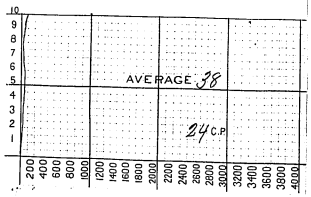
No 10 10 Night run A. Lamps 6½ x 9¼ Aug 21, 1882



6

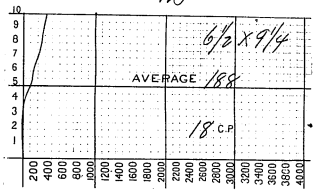
11 Day run A Lamps Aug 21, 1882.
6½ x 9¼

11

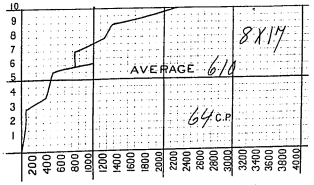


No 12 Night run A. Lamps 6½ x 9¼ Aug 21, 1882.

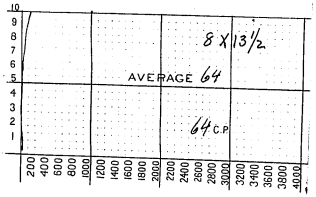
12



10 13 Lamps run off regular & blue entirely worked out of Bulbs & worked up to bulbs showing a clear white then immediately draw switch & seal off without current.



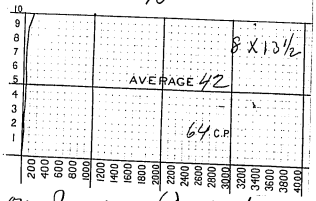
No 14 Fibre boiled in Distilled water for 30 minutes & then immersed in Kerosene (Hot) for 1 hr.



6

15 Fibre boiled in distilled Water for 1 hour and then immersed in Turpentine for 1 hour.

15

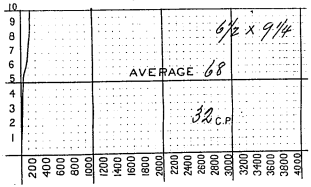


16 Carbons on Inside Parts boiled for 30 minutes in Distilled Water.

No 17 Carbons on Inside Parts Boiled for 30 minutes in Distilled Water & then immersed in Kerosene for 30 minutes.

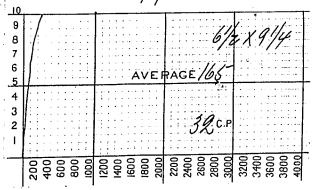
18 Double cover (No 2)

18



19

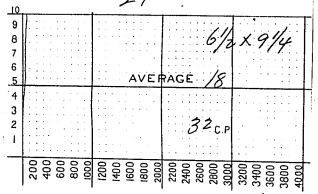
19



20 —

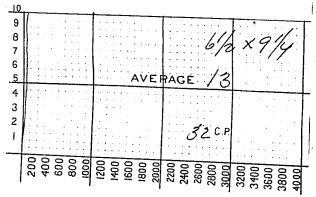
No 21 -

21



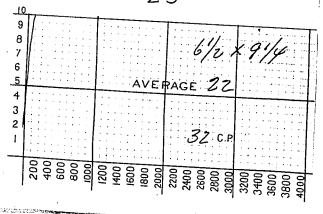
22

22



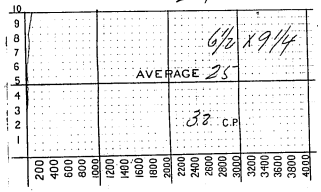
23 -

23



No 24 -

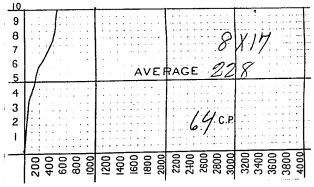
24



25 -

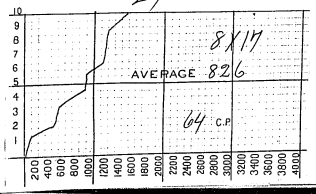
26 -

26



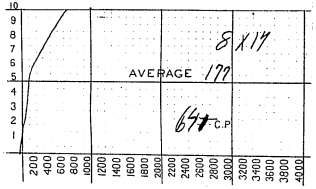
27 -

27



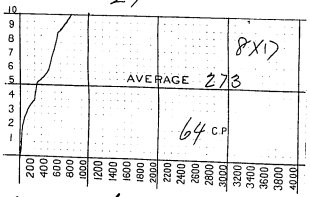
No 28

28



29-

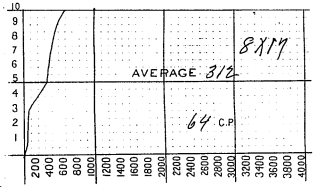
29



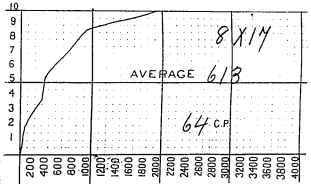
Regular nickel forms bottom of piles 8 X 17 immersed in oil.

No 30 Day run A. Lamps Aug 22, 1882

30

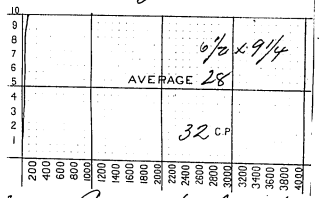


31- Night run A. Lamps Aug 22, 1882.

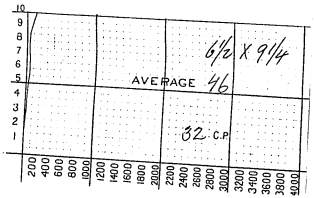


No Daytrun A lamps Aug 22, 1882.
32 6½x9¼ carbons

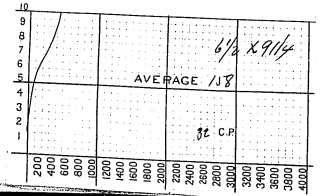
32



6 33 Nightrun A. 6x9¼ lamps Aug 22, 82

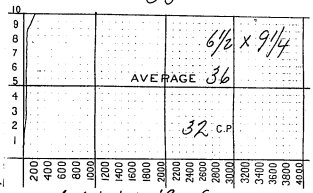


34 –



No 35 –

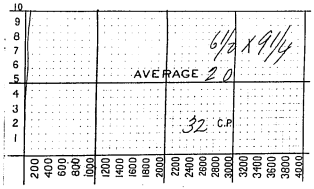
35



From top of piles (No. 3)

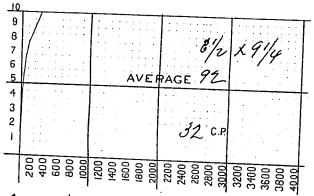
36 –

37 –



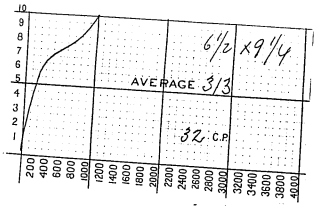
Carbon forms - top of piles - base with raised edges 6½ x 9¼
not immersed in oil.

No 38 -



Carbon forms bottom of piles 6½ x 9¼

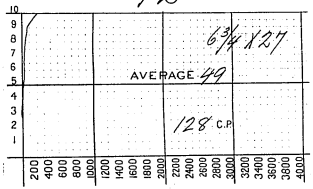
39 - (No 4) Carbons from top of piles
carbon forms 6½ x 9¼



40 -

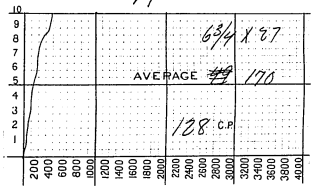
No 41 -

42



42 -

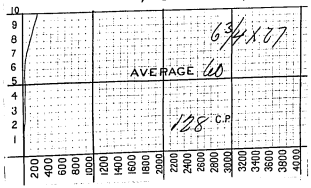
41



425

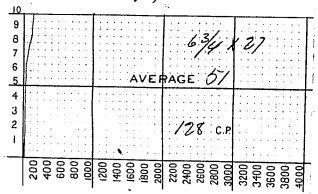
43 -

43



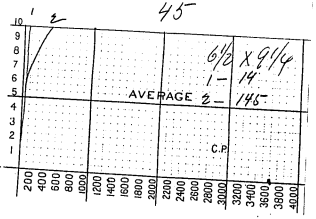
No 44

44



3, 45 - 8 carbon forms on top of Nickel forms in small covers (regular) 6½ x 9¼ not in oil.

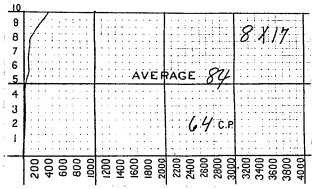
45



4 Set 2 worked by Howell.

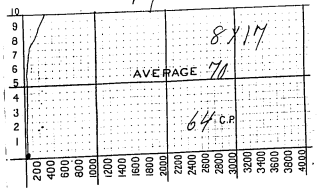
No 46 - Day run A, Lamps Aug 23, 82.

46



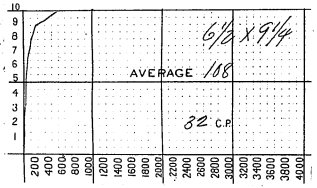
47 - Night run A Lamps Aug 23, 1882.

47



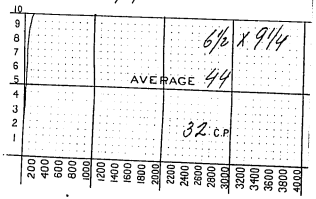
no. 48

48



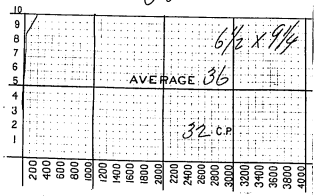
49 – From top of pile (no. 5).

49



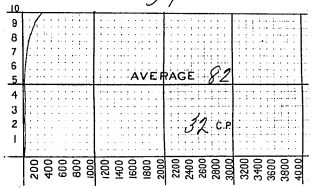
50 From bottom of pile (no 5)

50



no 51

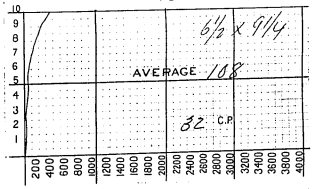
51



Double cover burnt cotton main body of carbons 6½ x 9¼ immersed in oil. Worked by Howell.

52

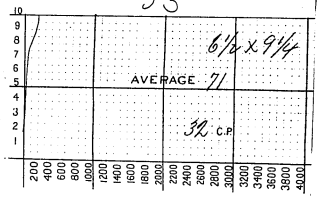
52



Carbon forms – top of piles 6½ x 9¼ immersed in oil. Worked by Howell.

No 53

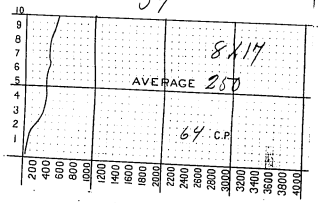
53



From bottom of piles (no6)

39, 54

54

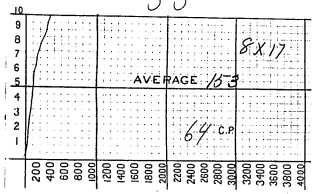


Regular nickel forme - top of piles 8 X 17 immersed in oil.

4

No 55

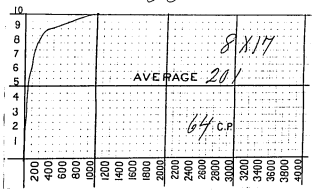
55



Regular nickel forme bottom of piles 8 x 17 immersed in oil.

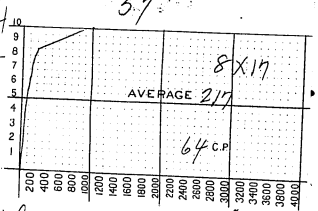
no56 - Day run A Lumpes Aug 24 1882.

56



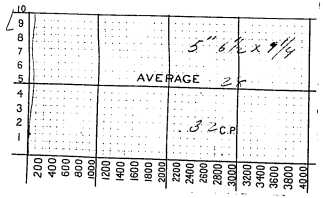
no 57 night run a Lamp Aug. 24, 1882.

57



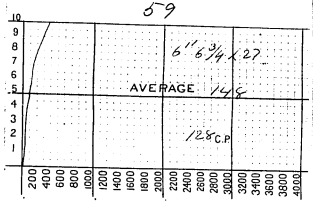
58 night run a Lamp 6X9 1/4 Aug 24

58



no 59

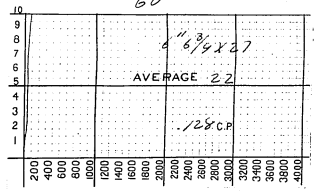
59



Regular nickel forms tops of piles 6 3/4 X 27 immersed in oil.

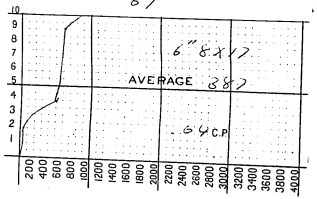
60

60



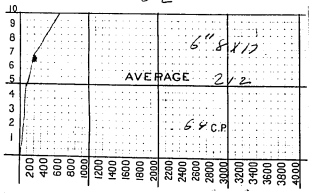
No 61 Lamps run off regular up to time blue is worked Clamps & then take off current & allow pumps to exhaust 10 minutes and then seal off with out current.

61



62 Bulbs washed with Hydrogen

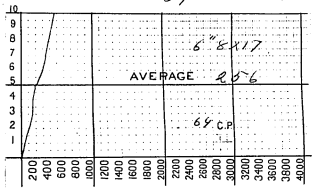
62



No 63 Bulbs washed with gasoline.

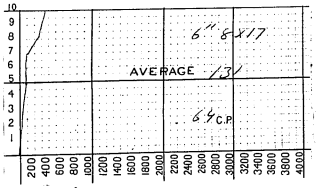
64 Day run a Lamps Aug. 25, 1892.

64



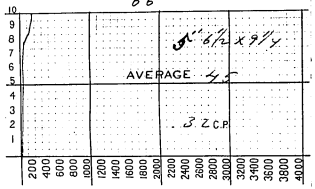
65 - Night run a Lamps Aug 25, 1892.

65



No 66

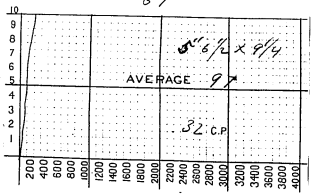
66



3. Anthracene in bottom of cover 6½ x 9¼ immersed in oil newly prepared. Worked by Howell

67-

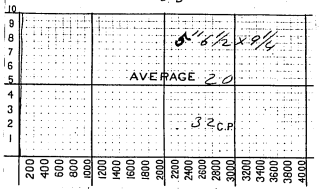
67



Three covers central of piles carbon forms 6½ x 9¼ immersed in newly prepared oil.

No 68

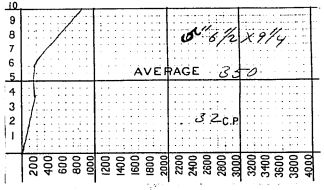
68



From top of piles 3 covers (No 8)

69

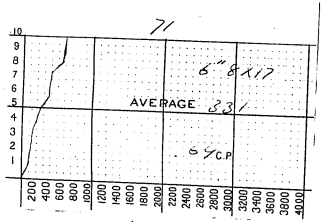
69



Three covers carbon forms 6½ x 9¼ bottom of piles.

70-Lamps marked XX filled with C.C.

110
71 Dayrun A Lamps Aug 26, 1882.

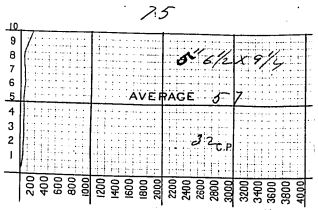


72 Carbons dipped in gasoline by Mr E.

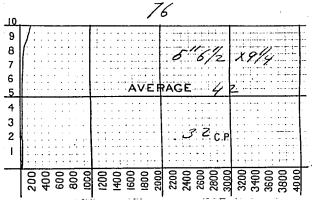
73 Clamps painted pink by Mr Edison

74 Clamps painted with photo chloride tin (mixed with water)

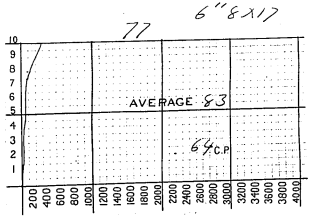
75 From top of piece.
Carbon forms sticks in small cover same as regular nickel forms
Clayed in regular way



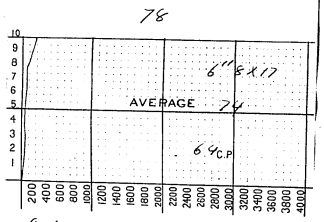
no
76 From bottom of piles.
Carbon forms stacked, straight, per #45



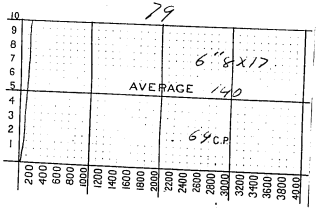
77 Edison's order marked E H Aug 28, 82.



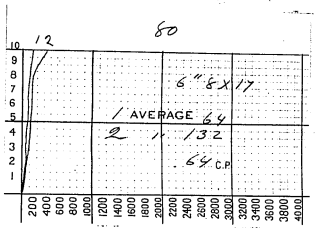
No 78 Edison's order marked E Aug 28, 1882.



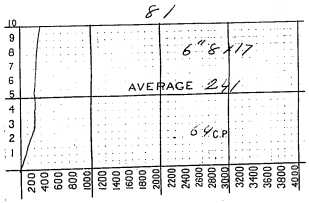
No 79 Edison's order marked X Aug 28, 1882.



No 80 Edison order marked S Aug 28, 1882.

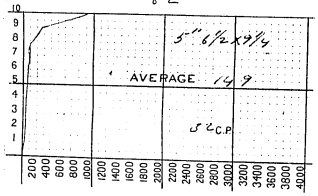


81 Edison order marked K. Aug 28. 82.



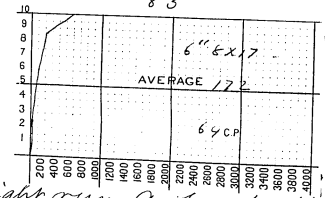
No 82 -

82



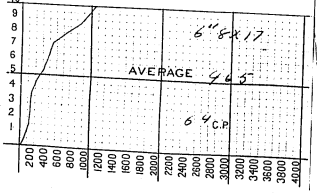
83 Day run a Lamps Aug 28, 1882.

83



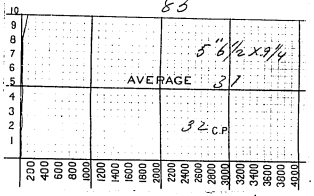
84 Night run a. Lamps Aug 28, 1882.

84



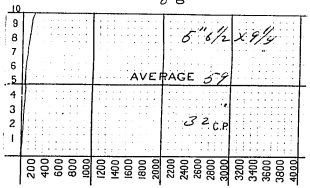
No 85 - Day run a Lamps 6½ x 9¼ Aug 28 1882

85

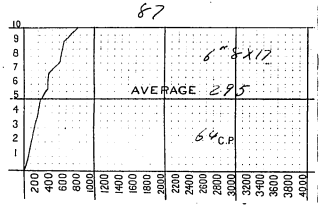


86 2 Carbons in one form 6½ x 9¼ Aug 29, 1882.

86

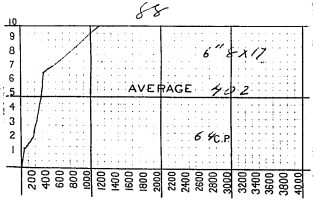


No 87 2 Carbons in one form 8x17 Aug 29 82

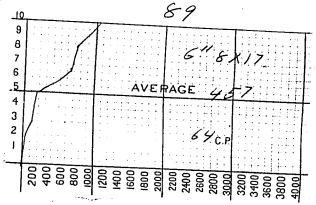


Worked by Howell.

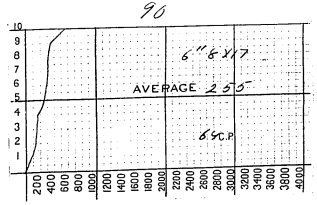
88 Day run A. Lamps Aug 29, 1882.



No 89 Night run A Lamps Aug 29, 1882



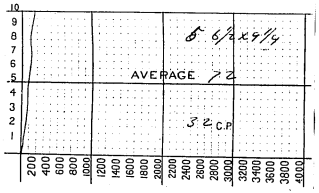
90 Lamps with bulbs attached containing P_2O_5 left on 4 weeks when they were sealed off and lamps set up. Aug 30, 1882.



No 91 - (no 11) carbon forms double cover 8x17 centre of piles.

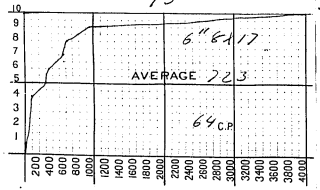
92 (no 12) carbon forms tin cover 6½x9¼ centre of piles.

92



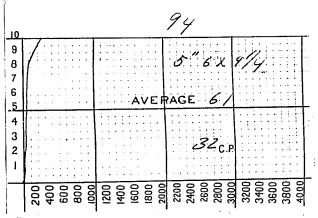
93 (no 11) main body of carbons 8x17

93



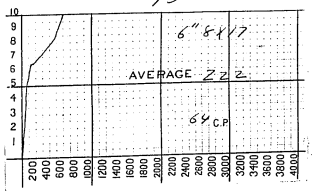
No 94 Lamps worked by Mr Edison order no changed from 36 6x9¼ fibres aug 30, 1882.

94



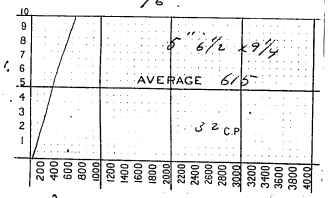
95 - Lamps worked by L. Hickman. 8x17 fibres aug 30, 1882.

95



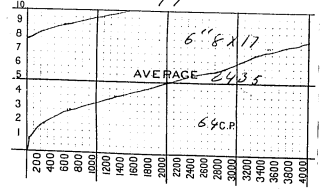
No 96 Lamps worked by Mr Holzer 6½ x 9¼ fibres Aug 30, 1882.

96



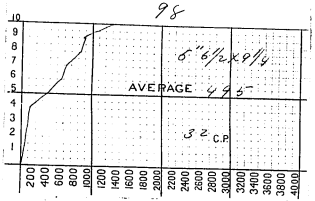
97 (No 13) Carbon forms two carbons from one form 8X17

97



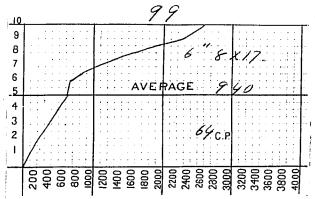
No. 98 (No. 13) Carbon forms 2 carbons from one form 6½ x 9¼

98

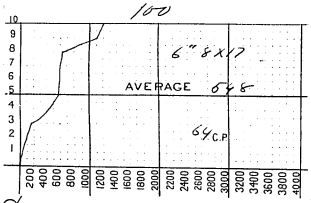


99 Regular nickel forms. top of piles 8 x 17

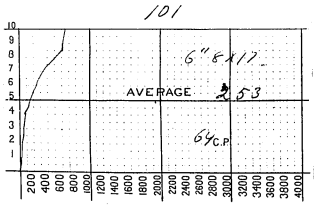
99



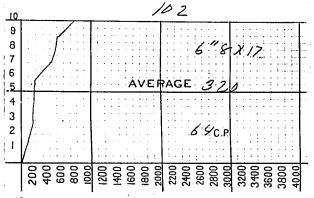
2/9 No 100 Regular nickel forms bottom of piles 8X17



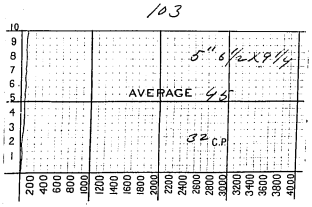
9 101 Day run A Lamps Aug 30, 1882.



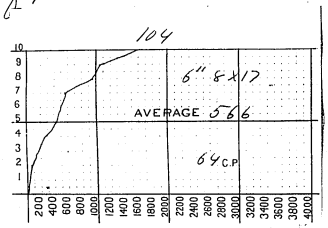
No 102 Night run A Lamps Aug 30, 1882.



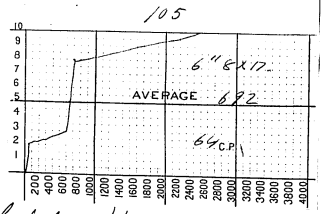
103 Lamps 6½ X 9¼ worked slowly until on 3rd line then works once high till blue is off clamps & left burning pretty high untill solid then sealed off.



No 104 Regular nickle forms - top of piles

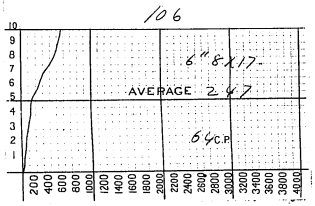


No 105 Reg nickel forms bottom of piles

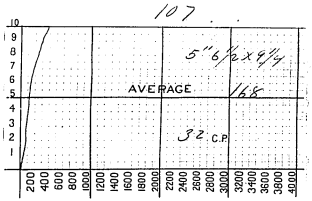


worked by Harvell.

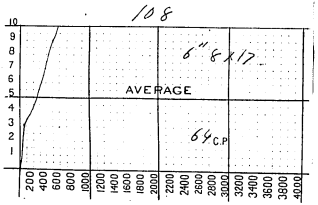
No 106 • (No 14) Double cover carbon forms 8X17



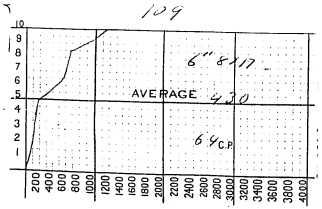
107 Triple cover Carbon forms, 6½X9¼



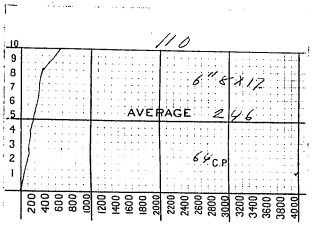
No 108 Fibres carbonized straight - worked by Sapelby. Sept 1. 1882.



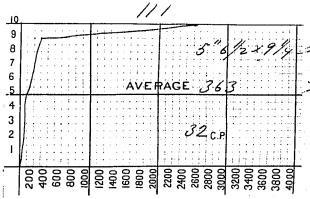
109 Day run A Lamps Sept 1, 1882.



No 110 Night run A Lamps Sept 1, 1882.



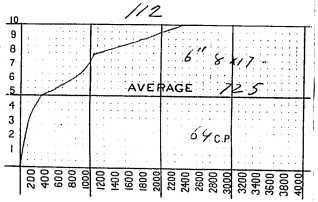
111 295 - fibres 5" 6½ x 9¼ carefully selected & considered perfect as to cutting Sept 2. 1882.



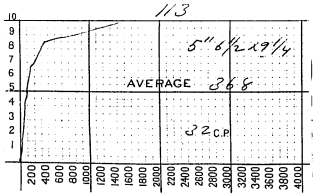
363
1 2 2
726
363
43 836

Worked by Howell

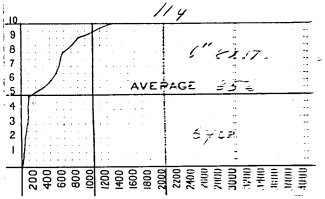
No 112 2 fibres in one form carbon form 8x17



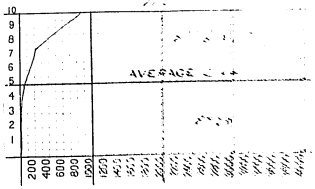
113 2 fibres in one form carbon forms 6"2 x 9"4



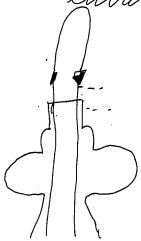
No 114 Regular nickel form top of piles 8 x 17

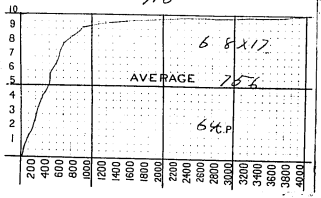


115 Regular nickel forms piles 8 x 17

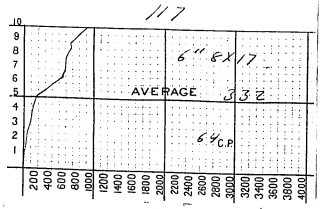


No 116 After carbons are plated in clamps solution in troughs lowered to point marked and current reversed

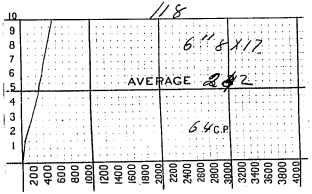




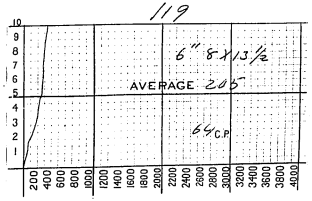
117 Fibres carbonized straight worked by Holzer Aug 30, 1882.



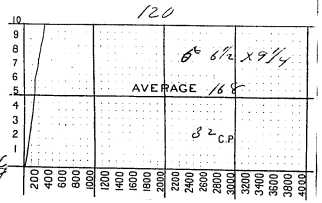
No 118 Day run a Lamps Sept 2, 1882.



119 Cover same style as no 11 used. 8x13½ fibres placed in carbon forms before baking forms run through in regular way.

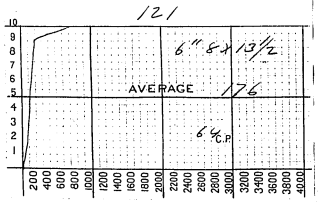


No 120 Cover same style as No 12 used 6 1/2 x 9 1/4 fibras placed in forms (carbons) before baking run through in regular way.

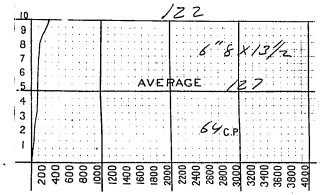


121 Reg

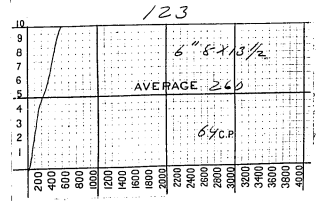
121 Regular nickel forms same as Aug 31st 1882. top of piles.



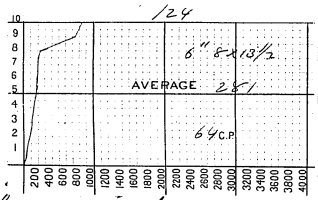
No 122 Regular nickel forms same as Aug 1st 1882 bottom of piles



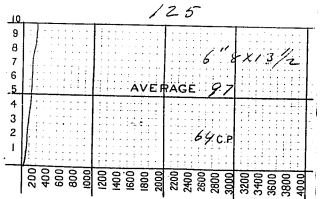
123 Regular nickel forms 400 ~~forms~~ covers 8 x 13 1/2 from top of piles



No 124 Regular nickel forms
400 form covers 8x18½ bottom of piles

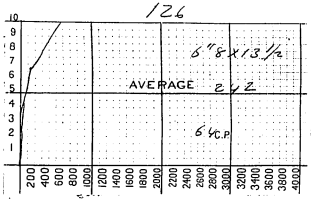


125 Lamps marked No. 1. Sept 4, 82.

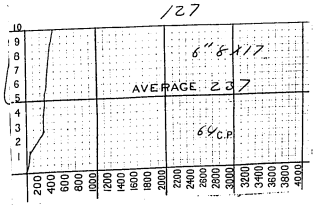


Bulbs direct from factory washed with solution oil and terchloride.

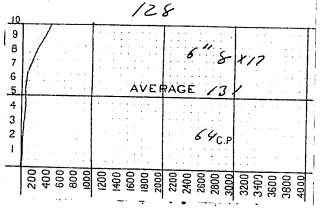
No 126 Lamps marked no 2. Sept. 4, 1882.
Bulbs direct from factory washed in distilled water and then with prepared solution of oil and terchloride.



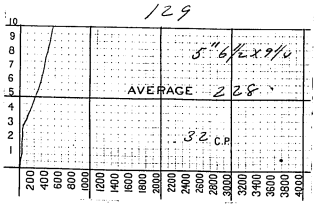
127 Day run a Lamp Sept. 4, 1882



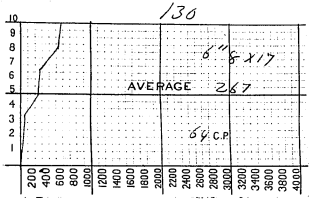
No 128 Night run A Lampe Sept 4, 1882.



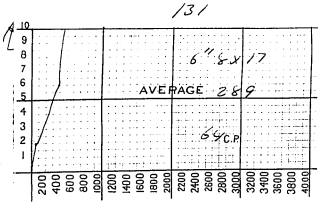
129 100 fibres 5" 6½ x 9¼ selected by J. J. Bradley per order F. R. Upton. Sept. 6, 1882.



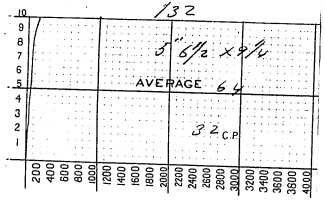
No 130 Day run A Lampe Sept 5, 1882.



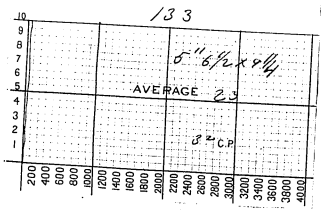
131 Night run A Lampe Sept 5, 1882.



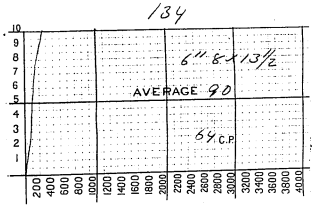
No 132 Day run A Lamps 6½x9¼ Sept 5, 1882.



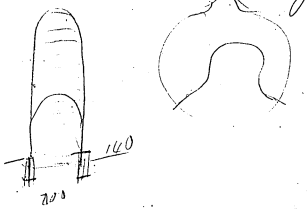
133 night run a Lamps 6½x9¼
Sept 5, 1882.



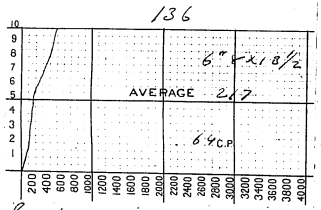
No 134 Lamps marked F, H. Sept 2, 1882.
Carbons immersed in hydrofluoric acid for 10 hrs and then washed in deluted ammonia & then in water for 3 hours and then dried, & run through in regular manner.



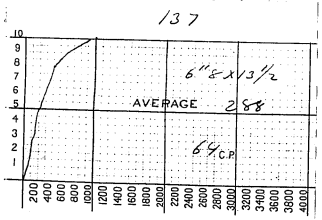
135 Switch put in when small bubbles are in tube otherwise regular.



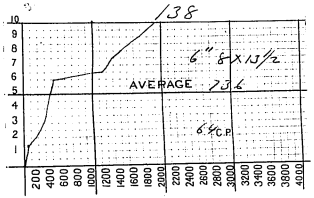
No 136. Switch put in when large bubbles are in tube otherwise regular



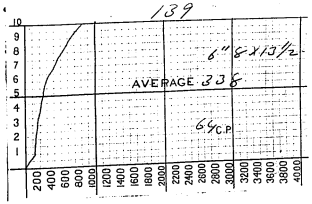
137 – Switch in at start otherwise regular.



No. 138 Switch in and one lamp cutout at start otherwise regular.

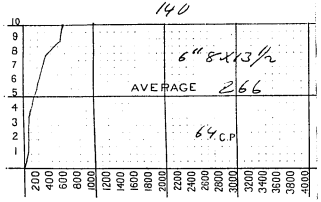


139 – Switch in and two lamps cut out at start otherwise regular



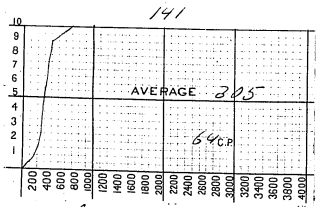
No 140 Switch in and 3 lamps cut out at start otherwise regular

140



141 Switch in and 4 lamps cutout at start otherwise regular.

141



142 Lamps cut out 1 at a time on pin hole - otherwise regular.

No 143 Lamps cut out 1 at a time on small bubbles otherwise regular.

144 Lamps cut out 1 at a time on large bubbles.

145 Lamps cut out 2 at a time on solid tube otherwise regular.

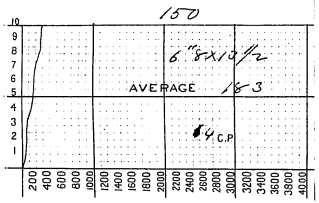
146 Lamps cut out 3 at a time on solid tube otherwise regular.

147 Lamps cut out 2 at a time on small bubbles otherwise regular.

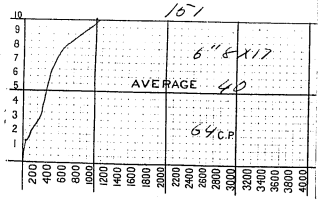
148 Lamps cut out three at a time on small bubbles otherwise regular.

149 Lamps cut out 2 at a time on large bubbles - otherwise regular.

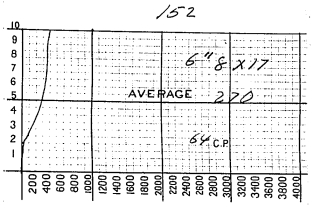
No 150 Lamps cut out 3 at a time an large bubble otherwise regular



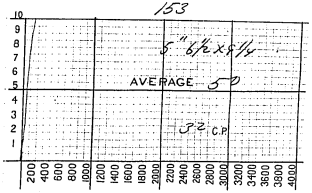
151 Day run A Lamps Sept 6, 1882.



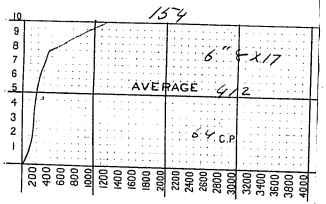
No 152 Night run A Lamps Sept. 6, 1882



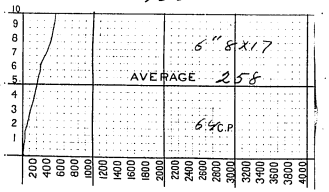
153 – Lamps put on pump & after solid tube was obtained current put on to carbon up to the time the blue appeared & left burning with blue on clamp and lamp taken off immediately after blue disappears.



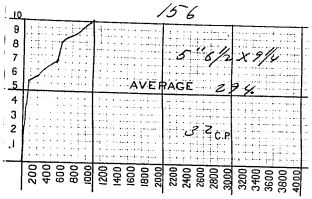
No 154 Day run Sept 7, 1882 a Lamps.



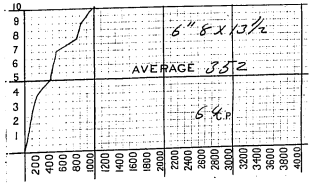
155 night run a Lamps Sept 7, 1882



No 156 night run Reg. 6½ x 9¼ Sept 7, 1882



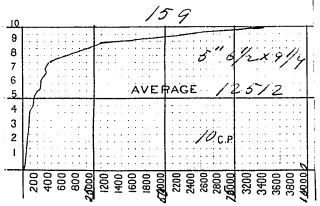
157 2 carbons in one form
Carbon forms
Forms filled before being baked 8 x 13½



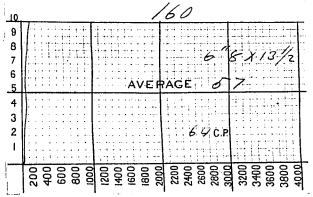
No. 158 2 carbons in one form carbon forms formed fibred before being baked 6½ x 9¼

159 - 20 A Lamps 6½ x 9¼ One lamp selected at random from orders 25, 35, 45, 48, 50, 51, 63, 66, 69, 86, 91, 92, 98, 107, 111, 120, 132, 133, 153, 156 and set up ~~at~~ 10 candles.

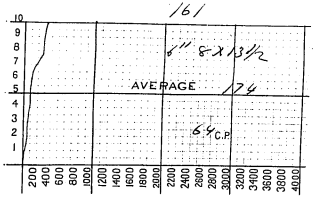
6/12.5/12
209 hours



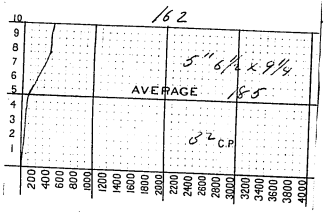
No. 160 Day run A Lamps Sept. 11, 1882.



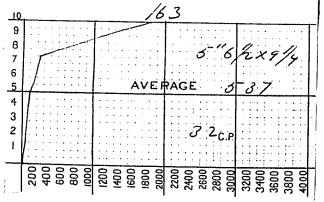
161 - Night run A Lamps Sept 11, 1882.



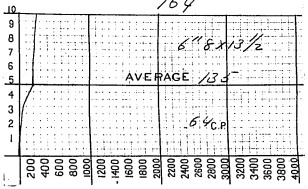
No 162 Day run a Lampe 6½x9¼ Sept 11, 82.



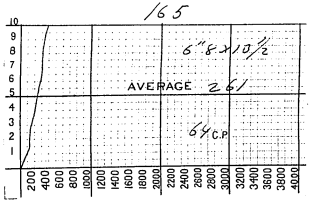
163 Night run a Lampe 6½x9¼ Sept 11, 1882.



No 164 Day run a Lampe. Sept 12, 1882.

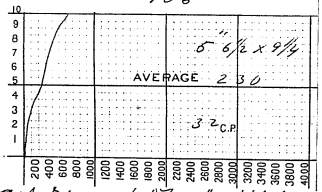


165 Night run a Lampe Sept. 12, 82.



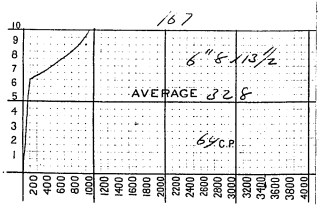
No 166 Style of cover no 13 Aug. 3, '82.
Carbon forms, 1 fibre in form 6½x9¼
Base and raised edges all one piece

166



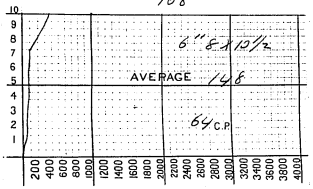
167 – Day run A Lamps Sept 13, 1882

167



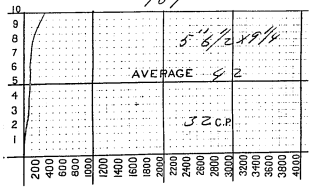
168 Night run A. Lamps Sept. 13, 82.

168

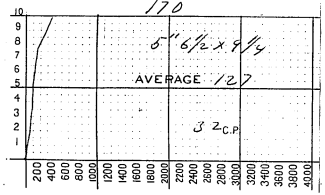


169 Day run A Lamps Sept 13, 82.
6½ x 9¼

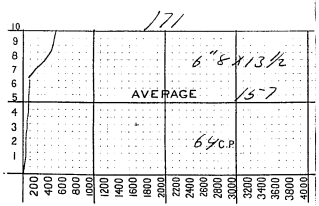
169



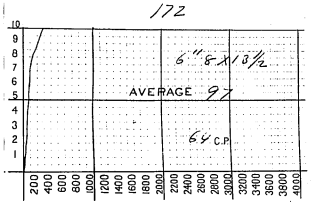
No 170 night run a Lamp 6½x9¼ Sept 13, 1882



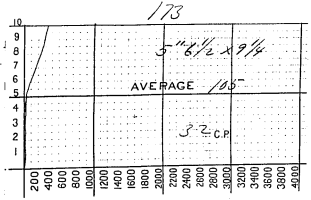
171 – Day run a Lamps Sept 14, 1882;



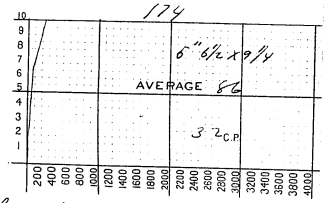
No 172 night run a Lamps Sept 14, 1882



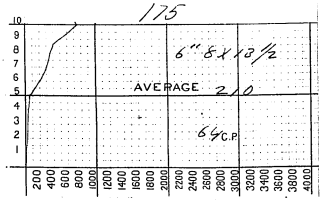
173 Day run a Lamps 6½x9¼ Sept 14, 1882;



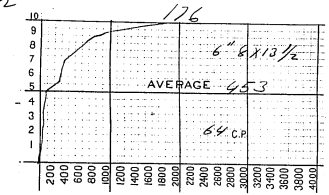
No 174 Bright run a Lamps 6½x9¼ Sept 14, 1882.



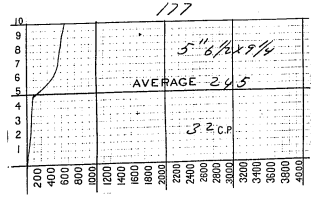
175 Lamps marked Eureka worked off from pumps without drying on the dryer or heating on the heater worked by Saxelby.



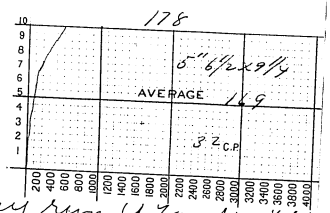
176 Carbon forms large covers clayed in regular way 2 fibres in one form forms from top of piles 8x13½



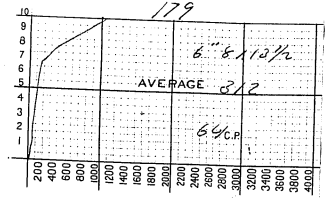
177 Carbon forms cover (No 13) base and raised edges one piece. One fibre in form from top of piles 6½x9¼



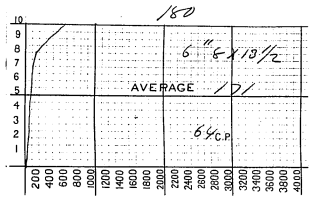
No 178 Carbon form cover (No 13) base and raised edges one piece one fibre in form. from centre of pile 6½ x 9¼



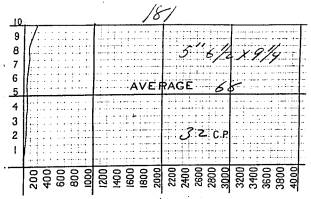
179 Day run A Lamps Sept. 15, 82.



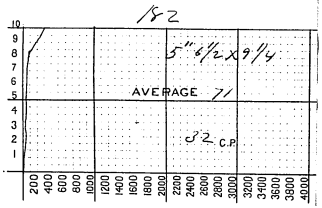
No 180 night run A Lamps Sept. 15, 82.



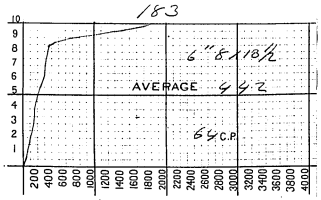
181 Day run A Lamps 6½ x 9¼ Sept. 15, 82.



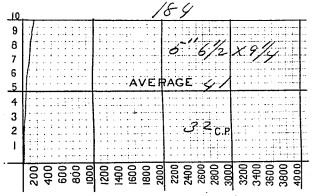
No 182 Night run A Lamp 6½x9¼
Sept 15. 82.



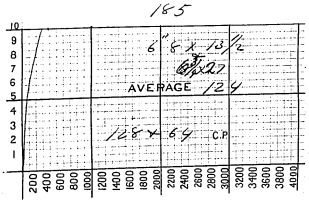
183 Day run A Lamps Sept 16, 1882.



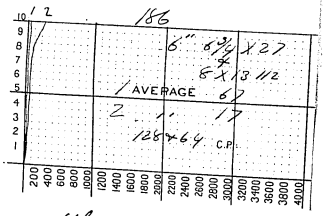
No 184. Day run A Lamps 6½x9¼
Sept 16, 1882



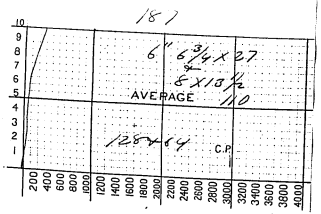
185 Reg lamps on pumps rapidly for sealing off. reworked with reversed current



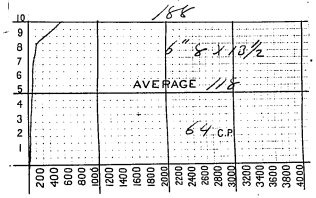
No 186 Lamps with mercury in exhausting tube.



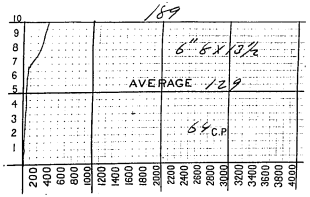
187 Lamps without mercury in exhausting tubes.



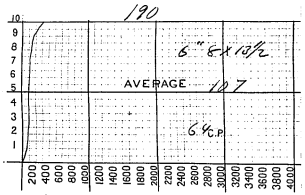
No 188 Day run a Lamp Sept 18, 1882.



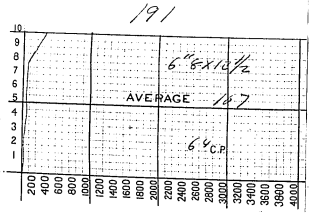
189 Night run a Lamp Sept 18 1882.



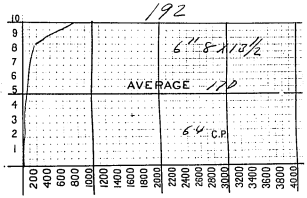
No 190 Small duplicate of regular run new-style covers 2 fibres in form 8X18 1/2



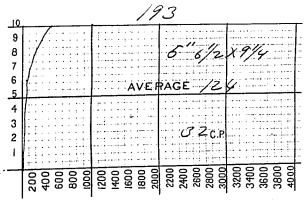
191 Day run A Lamps Sept 19 1882.



No 192 Night run A Lamps Sept 19, 1882.

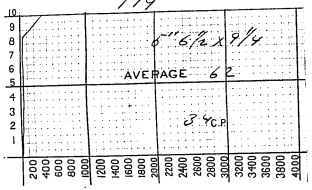


193 Day run A Lamps 6 1/2 X 9 1/4 Sept 19, 1882.



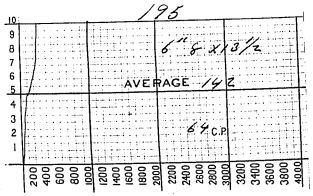
No 194 Night run a lamps 6"x19¼ Sept 19 1882.

194



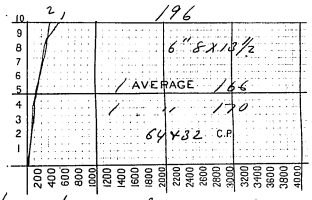
195 Same as No 190

195



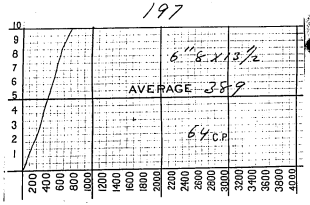
No 196 Lamps from new pumps with straight fall Sept. 21, 1882.

196

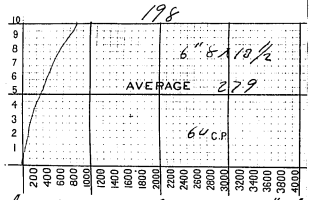


197. Lamps with exhausting tube one foot longer than regular run off in regular way Sept. 21, 1882.

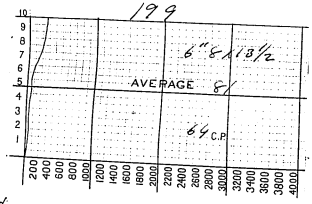
197



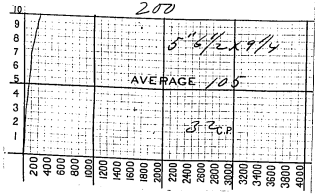
No 198 Day run a Lamps Sept 20, 82



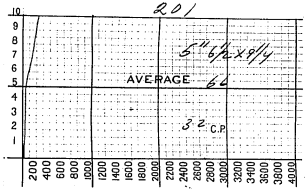
199 Night run a Lamps Sept 20, 82.



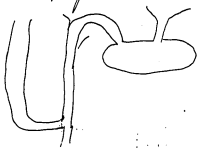
200 Day run a Lamps 6 1/2 x 9 1/4 Sept 20 1882,

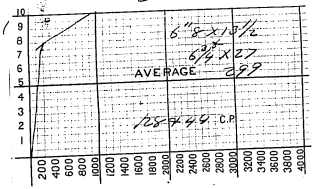


201 Night run a Lamps 6 1/2 x 9 1/4 Sept 20 82.

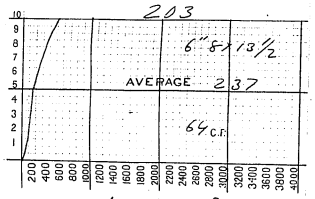


202 Lamp from this style pump Sept 21 82,

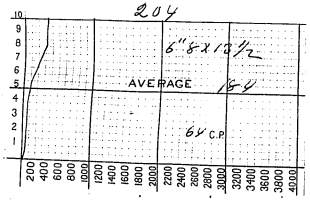




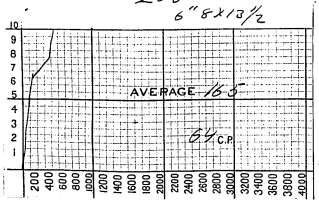
No 203 - Same as no 190.



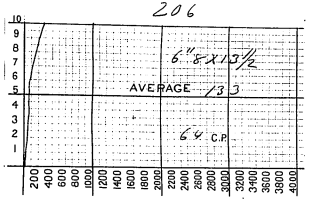
204 New run of carbons Sept. 22, 1882.



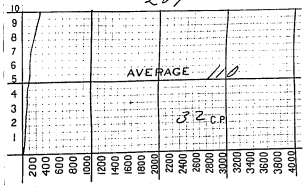
205 Day run A Lamps Sept. 21, 1882



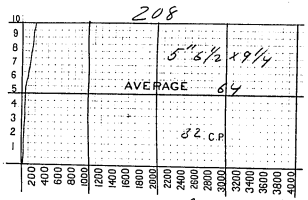
No 206 Night run A Lamps Sept 21, 1882.



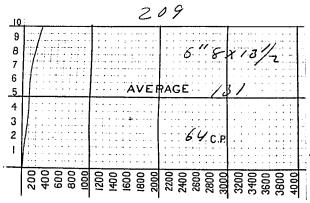
207 Day run A Lamps 6½x9¾ 9/21/82



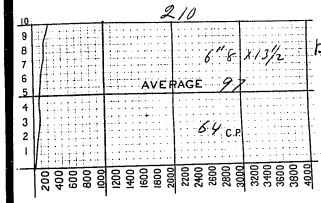
No 208 Night run a Lamps 4½ x 9¼ Sept 21, 1882.

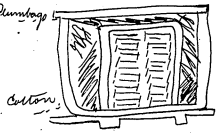


No 209 Day run a Lamp 9/22/82.

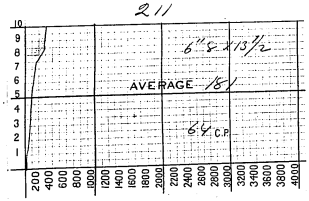


No 210 - Small duplicate of regular run 2 fibres to forms, 8 x 13½ New style cover No 2

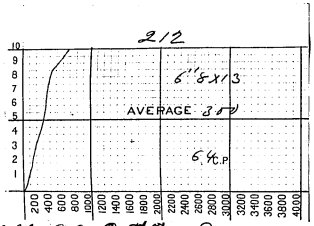




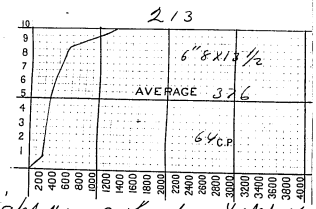
211 Small covered carbon forms 2 fibres in form 8 x 13½ Phosphorus pentoxide in bottom of cover.



No 212 Same as order 210

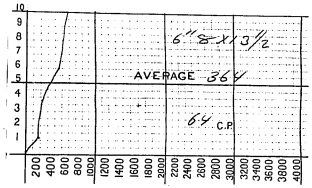


213 same as order 210

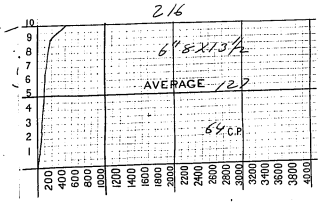


214 Night run a Lamps Sept 27, 1882.

No 215 - B. Pth fibres old stk. surrounded on all sides by O 2 O.5 in a box which was kept in a warm dry place for 12 da. Fibre carbonized Sept. 27, 1882

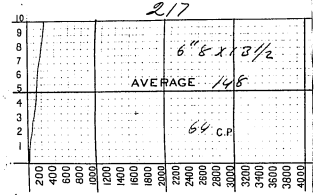


216 - Lamps ordered to be put up by Mr Edison Sept. 28, 1882
Regular lamps



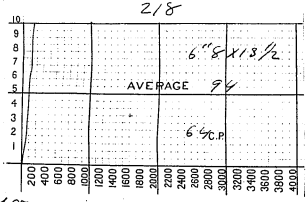
No. 217 Day run A. Lamps Sept 28, 1882.

217



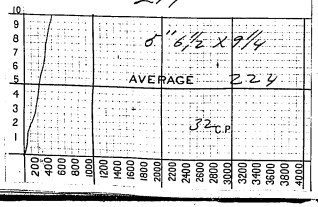
218 Night run A. Lamps Sept 28, 82.

218



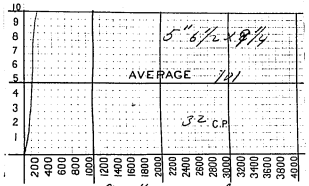
219 Day run
A Lamps 6 1/2 x 9 1/4
Sept 28, 82

219



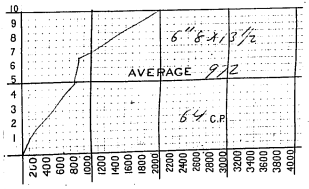
No. 220 Night run A Lamps 6 1/2 x 9 1/4 9/28/82.

220



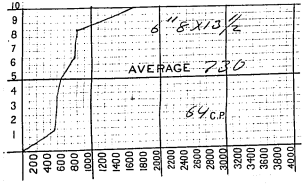
221 Day run A. Lamps Sept. 29, 1882.

221



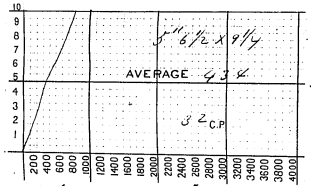
222 Night run
A Lamps Sept.
29, 1882.

222

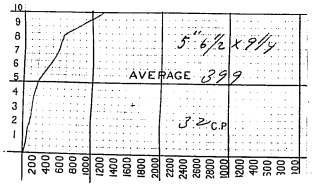


No. 223 Day run a lamp 6½x9¼ 9/29/82

223

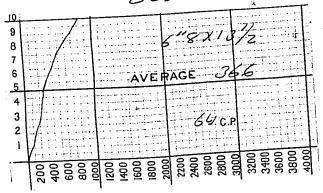


224 Nightrun a Lamps 6½x9¼ 9/29/82.



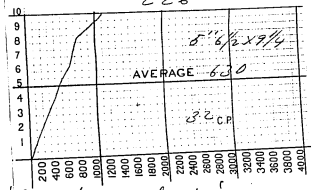
225 Day run a Lamps 9/30/82

225



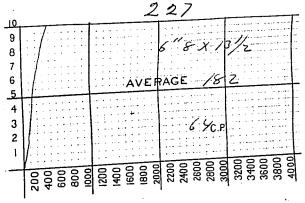
No. 226 Day run a Lamps 6½x9¼ Sept 30, 1882.

226



227 Lamps worked in regular way by 2. brown except they were sealed off high.

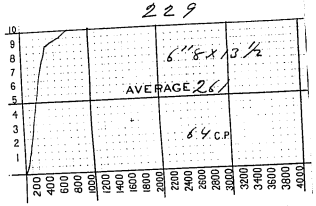
227



228 - Set of 20 lamps 6½x9¼ to be setup at 10 candles.

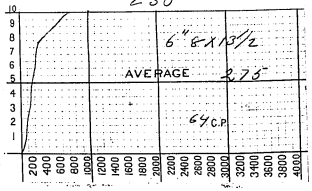
no 229 1000 8"x13½ 6" Inspected by machine —

229



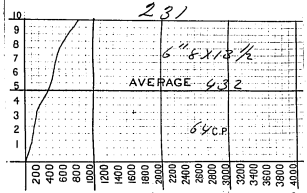
230 Lamps heated on dryer - heated by 4 - 32 candle lamps and left on for 45 minutes.

230



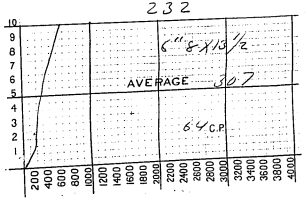
W. Day run a Lamps Oct 2, 1882.
231

231



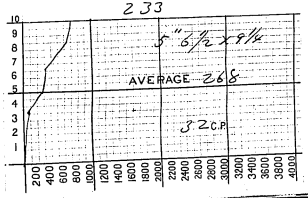
232 Night run a lamps Oct 2/82.

232



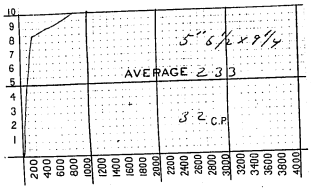
233 Day run a Lamps 6½x9¼ 10/2/82

233



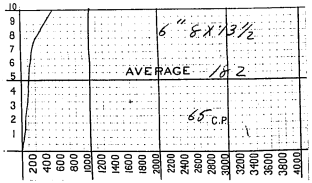
No 234 Night a. 6½ x 9¼ Oct 2, 1882

234



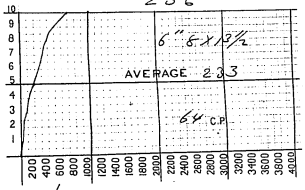
235 Lamps heated on dryer heated by 4 - 32 candle lamps for 2½ or 3 hours —

235



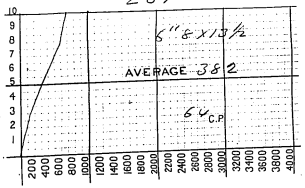
No 236. Lamps with bulbs attached containing P_2O_5 left on 8 weeks after which they were set up 10/4/82.

236

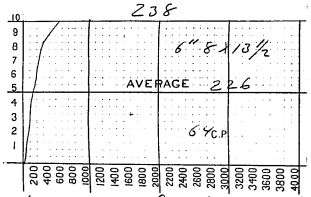


237 - Day run a lamps 10/4/82.

237



No 238 night run A Lamps 10/3/82.

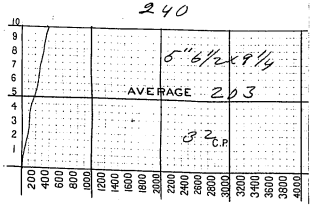


239 - Day run A. 6½ x 9¼ 10/3/82.

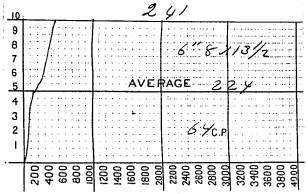
Sheet

Avg. mins 243
32 Candles

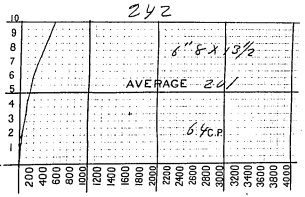
240 night run 6½ x 9¼ 10/3/82



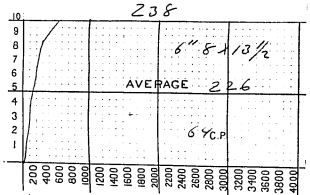
241 Lamps marked N. P.



242 - 10 regular carbons avg resist 285 soaked in strong solution. Sugar in water and recarbonized. After recarbonization avg resist 241



2 No 238 night run A Lamps 10/3/82.

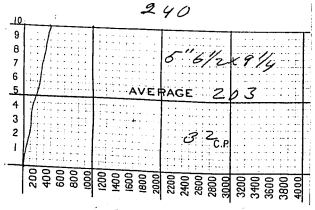


239 - Day run A. 6½ x 9¼ 10/3/82.

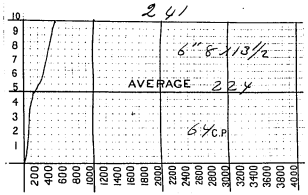
Sheet

Avg. mins 243
32 candles

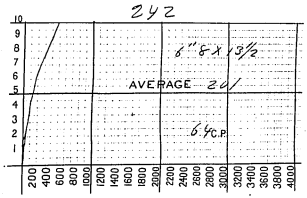
240 night run 6½ x 9¼ 10/3/82



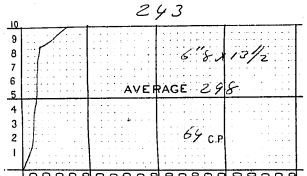
241 Lamps marked N. P.



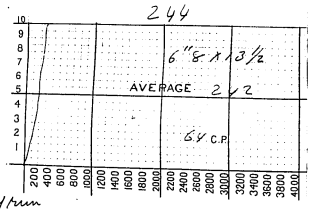
242 - 10 regular carbons avg resist 285 soaked in strong solution. Sugar in water and recarbonized. After recarbonization avg resist 241



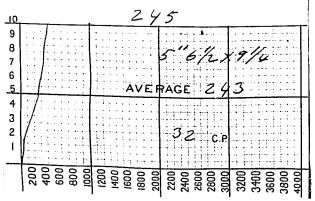
2 No 243 Day run a Lamps Oct 4, 1882.



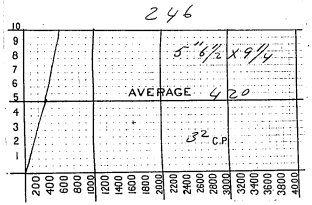
244 Night run a Lamp Oct 4, 1882.



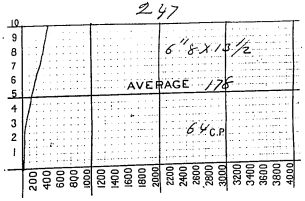
245 Day run a Lamps 6½x9¼ 10/4/82



No 246 Night run a. Lamps 6½x9¼ 10/4/82.

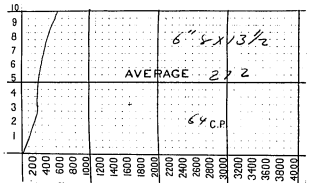


247 - Lamps heated on dryer - heated by lamps - left on one hour final temperature 150° Fahr -



No. 248 Day run a Lamps. 10/5/82

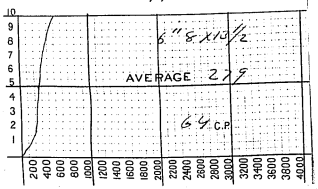
248



249 – Night run a. Lamps 10/5/82.

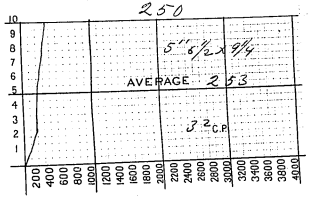
250 Day & night runs a Lamps 6½x9¼ Oct 5, 1882.

249



No 251 Carbons immersed in hot alum water Oct 6, 1882.

250

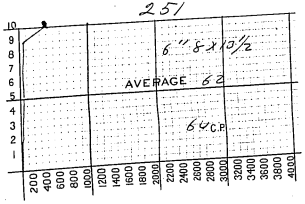


252 – Lamps considered poor vacuums

253 Lamps marked "Edison 1"

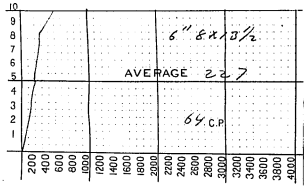
Lamps run off regular way but never working higher than about 125 Volts.

251



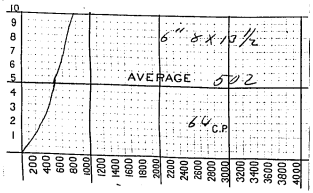
No 254 Lamps marked "Edison 2"
Lamps run off regular way with the exception of not connecting until the tube is solid.

254



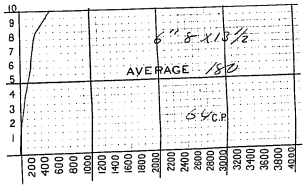
255 - Lamps marked "Edison 3"
Lamps brought up to a dull red & then let run on clear tube for 1 hour and then brought up regular.

255



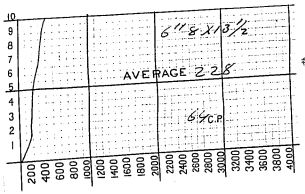
No 256 Lamps marked "Edison 4"
Lamps run off with wires not connected until solid tube is obtained when the current is put on for a few seconds, & again taken off until solid tube is again obtained & so on up to finish.

256

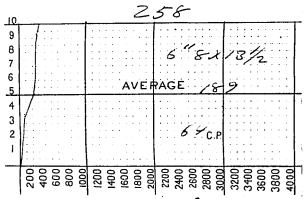


257 - Day run A Lamps Oct 6, 1882.

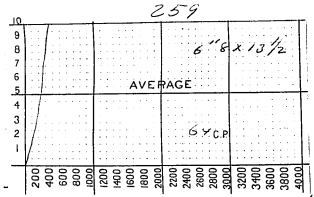
257



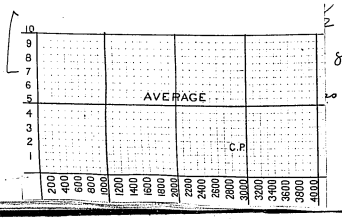
no 258 - Night run A Lamps 10/6/82.



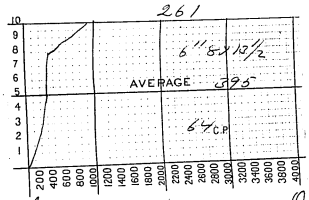
259 - Day run A. Lamps 10/7/82.



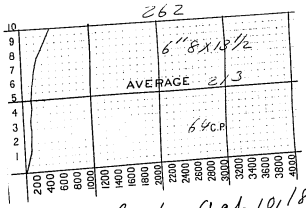
260 - Day run A. Lamps 10/9/1882.



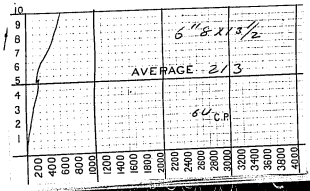
No 261 night run A lamps 10/9/1882.



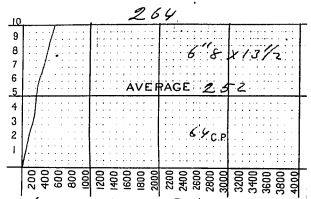
262 Same as order 25-5 Oct 10, 1882.



263 Day run A. lamps Oct 10, 1882.

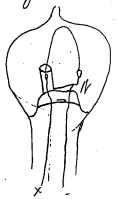


264 Night run A. Lamps Oct 10, 1882.

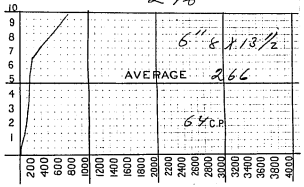


2 265, 266, 267, 268, 269, 270, 271
272, 273 & 274
2 K. fibres made in pairs from the same splint.

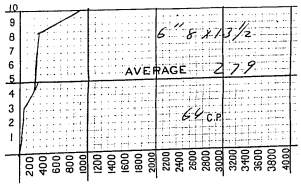
275 Lamps made with a copper tube surrounding the + clamp & connected to the - clamp - tube to come
2 just above top of clamp thus. —



No -
276 Lamps marked P
Parafine used instead of oil on stoppers on pumps

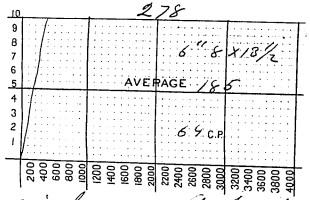


277 Same as 255 Oct 11. 1882.



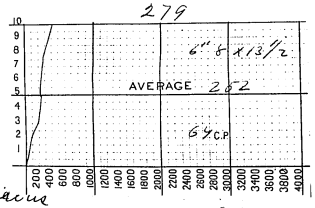
2 No 278 Day run A Lamps Oct 11, 1882.

278



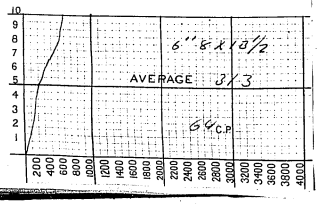
2 279 Night run A. Lamps Oct 11, 1882.

279



2 280 Lamacus 255 Oct 12 1882

280

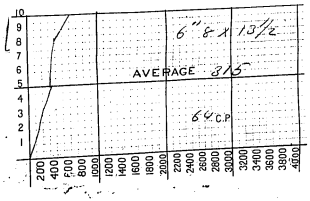


#281 Fibres soaked 15 hours in solution of sugar in water - about 30% sugar by weight -.

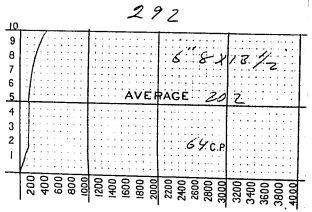
#281, 282, 283, 284, 285, 286, 287 288, 289, 290.
Fibres cut in pairs from the same splint. Oct 13, 1882. fibres 6 x 4 ss.

291 Day run A Lamps Oct 12, 1882.

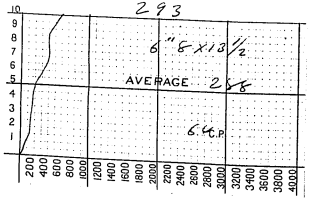
291



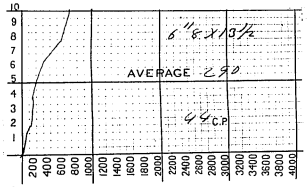
No 292 Night run A. Cup Oct. 12, 1882



293 Same as 255 Oct 13, 1882.



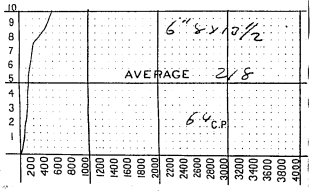
294 Day & night run Oct. 11, 1882.
set up at 1 candle for 8 1/2 hours & then tested at 64 candles.



295 - Lamps from pumps with loose cotton wool in phosphorus cup.

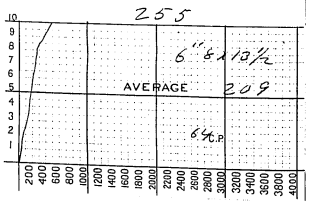
No 1296. A carbons 8X13½ twisted so that fronts of shanks face each other.

296



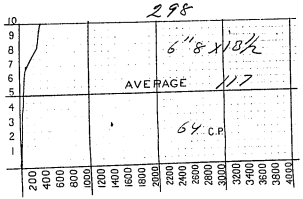
1297. Same as 255 - Oct 13, 1882.

255



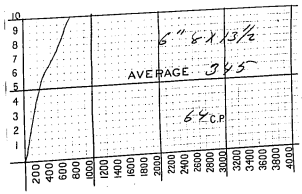
No 1298 - Day run A Lamps Oct 13, 1882.

298



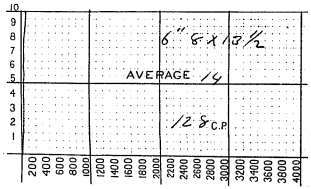
1299 - Night run A. Lamps Oct. 13, 1882

299



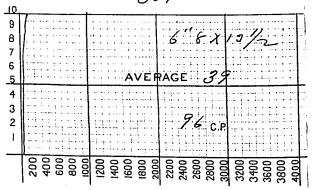
No. 1300 - Regulars set up at 128 candles
Oct. 14. 1882. 6" 8 x 13½

300



1301 - Regulars set up at 96 candles
6" 8 x 13½ Oct 14. 1882

301



Charles Batchelor Notebook, Cat. 1235

This notebook covers the period May 1883-June 1909. Most of the entries date from 1883-1885. All of the entries are by Charles Batchelor. The book contains numbered experiments 1301-1403, along with several pages of unnumbered entries. The material relates to electric lamps, dynamos, ore mining and milling, and an electric motor for the Edison-Sims torpedo. The spine is labeled "Expt 1302-." The book contains 284 pages, numbered by an archivist.

Blank pages not filmed: 97-98, 101-104, 109-124, 129-146, 157-234, 237-266.

Experiments.

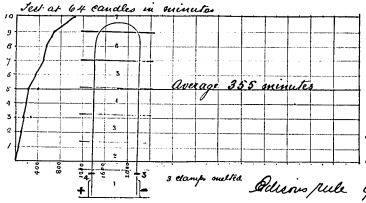
184

1301. Incandescent Lamps.

Edison A 16 c.p. Fabrication 24 May 1883. Sorg.

Size before carbonization 6" X ·008 X ·017

Test at 64 candles in minutes



At normal C.P. =

Resis. hot	95.6 ohm
Volts	95
Amperes	0·99
Kilogmts	9.6
Lamp per H.P.	7.8
Average life	887 hrs

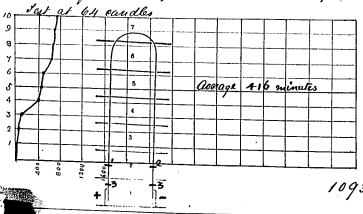
Edison's rule 933 hours

2. Incandescent Lamps.

Edison A 16 c.p Fabrication 1st June 1883 at Sorg.

Size before carbonization 6" X ·008 X ·017

Test at 64 candles



At normal C.P. =

Resis. hot	101.5 ohm
Volts	96.
Amperes	0·94
Kilgmts	9.2
Lamps per H.P.	8.1
Average life	1040 hrs

1093 hours

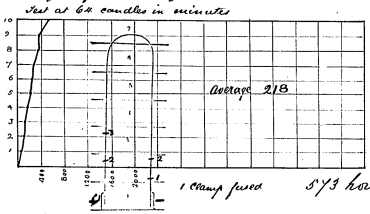
3 Incandescent Lamps.

184

Edison A 16 c.p. Fabrication 6th March 1883. Sorg.

Size before Carbonization 6" X ·008 X ·0135

Test at 64 candles in minutes



At normal C.P. =

Res. hot	133.5
Volts	101.1
Amperes	0·76
Kilgmts.	7·8
Lamps per H.P.	9·6
Average life	545 hrs

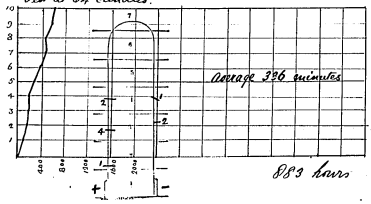
573 hours

4 Incandescent Lamps.

Edison A 16 c.p. Fabrication 13 June 1883 at Sorg

Size before Carbonization 6" X ·008 X ·017 inches

Test at 64 candles.



At normal C.P. =

Resist hot	106·4
Volts	97·8
Amperes	0.91
Kilgmts.	9.1
Lamps per H.P.	8.2
Average life	840 hrs.

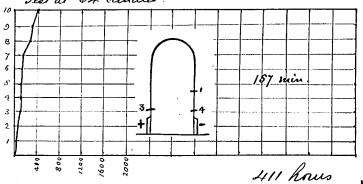
883 hours

5. Incandescent Lamps.

Edison B 16 c.p. Fabrication 28 May 1883 Ivey

Size before carbonization.

Test at 64 candles



411 hours

At normal C.P.–
Res. hot 30.8 ohms
Volts 47.
Amperes 1.5
Kilgmts 7.3
Lamps per H.P. 10
Average life 393

164

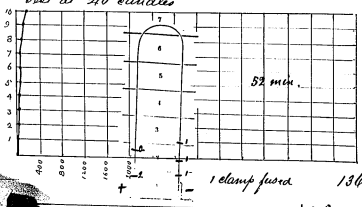
6. Incandescent Lamps

Edison A 10 c.p. Fabrication end of April 1883

Size before carbonization 5·X

Ivey.

Test at 40 candles



1 clamp fused 136 hours

At normal C.P.=
Res. hot 171·1
Volts 95.
Amperes 0·5
Kilgmts 5·3
Lamps per H.P. 14
Average life 130

164

7. Dynamo Electric Machines – June 18th 1883.

Type Edison Z altered. Barmature Res. 0·042 ohms

Time	Revs	Lamps	Volts	Amperes	Temp° Cents
8·27	1224	1	105		18°
8.37	1218	62	95	31·5	18·5°
9.04	1218	122	93	72	20·5
9.20	1228	128	92.5	77	20·5
9.40	1212	156	89	86	21
9.45	1202	176	88	94	21
9.52	1182	216	84·3	111	21.3
		216			22.5
10.43		216		110	23.2
10.55		216		107	23
11.		216		110	25
11.20	1202	216	84	109.2	25
11.27	1239	66	96·5	41	25
11.35	1298	7	104.5		25

Changes from old Z:–

Core:– Length

Diam.^er 0.1075 instead of 0.165

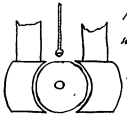
Weight the same

Wire:– 47·5 Kilo #16 wire on each core instead of 31 Kil. of #14

Resistance of core 23 ohms. or 46 total

Barmature instead of A

The temperature was taken with thermometer 2 centimetres from armatures.



Dynamo stopped the thermometer showed 70°C when placed on it

165

8 Dynamo Electric Machines June 21st 1883

Same machine as No 7 exp. with the following changes:
1° The Line base 5% higher to prevent the carrying of magnetism – 2nd The magnet wire wound on without paper insulation (except one thickness next to the core) and passed through a hot bath of resin and paraffin

Time	Rev.	Amps	Volts	Amperes	Cent° Temp°	Volts gained over Exp 7
7.40					17°	
8.20	1217	1	102.9		17	
8.32	1280	1	107.6		17	
8.37	1228	41	101.9	27		
8.45	1191	60	98	41	16	4
8.52	1211	120	95.4	78.5	18	3
8.59	1226	120	96	78.5		
9.10	1357	15	113.4	17.	18.5	
9.27	1240	165	94.7	95	19	4.7
9.34	1220	210	92.6	115.5	19.5	7.3
9.40	1212	270	87.8		21	
9.50	1391	60	119	45.5	20	
10.55	1473	15	123.8	12.5		
11.	1247	60	100.8	38.1		3.8
11.10	1214	120	95.4	76		5.5

Remarks:–
Wire on magnets does not heat at all

Result:–
We gain 4.4 volts, representing $\frac{1}{20}$ of the speed

Insulation between wire and core = 6 Megohms.

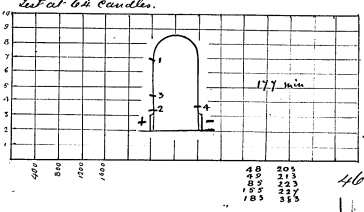
Composition of Compound
3.3 lbs. resin No 0.23.
1.7 " paraffin " 1.75

105 a

9. Incandescent Lamps June 21st 1883

Type Edison B 16 c.p. Bamboo fibre Jory.
Size before carbt. 3·X·008 x ·027 inches. Made 5 June 1883

Test at 64 candles.



At normal C.P. =

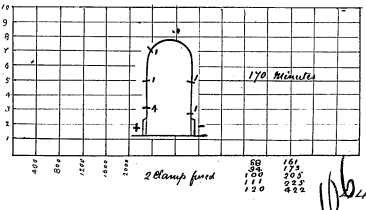
Res. hot	35.3
Volts	52.2
Amperes	1.4
Kilgrms	7.8
Lamps per HP.	9.4
Average life	442 hrs

465 hours

10 Incandescent Lamps June 22 1883.

Type Edison B 16 c.p. Bamboo fibre 3·X·008 x ·027 inches
Jory. Made 28th May 1883

Test at 64 candles.



At normal C.P. =

Res. hot	34.6
Volts	53.
Amperes	1.5
Kilgrms	8.2
Lamps HP.	9.1
Average	425

446 hours

11 Incandescent Lamps

Type Swan new model

June 30th 1883. Paris –

	16 Candles	20 Candles	25 Candles	64 Candles	Cold
Resistance hot	98.6	99.7	96.		198.5
Volts	95.5	97.5	102	125	
Ampères	0.96	0.97	1.06		
Kilogrms	9.4	9.7	11.		
Lamps per HP	7.9	7.7	6.8		
Life				57 Sn	

107

Dimension of Carbon after carbonization 7.25 x .009 inches

Section ⊙ circular.

E.H. Johnson brought me two to test from London one broke whilst being tested at 16 c.p.

12 Incandescent Lamps.

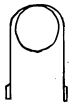
Paris June 30th 1883

Type Edison A 16 Bamboo with loop in

Section ▭ Size cut: 6. x .008 x .0135 inches

	1	2
Resis hot	129.7	132.1
Volts	101.5	105.8
Ampères	0.7	0.8
Kilgrms	8.	8.6
Lamps per HP	9.2	8.7

108

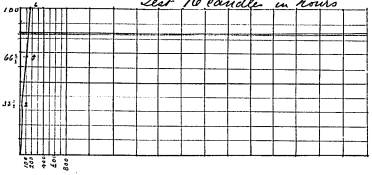


13. Incandescent Lamps.

Paris June 30th 1883.

Type Greiner et Friedrichs – Germany.

Test 16 candles in hours



1 – 7.32 min
2 109.20
3 298.09
3 414.61
hr 138.20

at 16 candles	1	2	3	4	5	6
Resis. cold	305	280	305	310	300	290
" hot	157.3	141.9	153.6	151	154	157
Volts	104	105.5	105.2	107.8	105.5	107
Ampères	0.65	0.74	0.68	0.71	0.68	0.68
Kilogrms	6.9	7.9	7.3	7.8	7.3	7.4
Lamps per HP.	10.8	9.5	10.2	9.6	10.2	10.1

109

At 64 candles 3 broke inside of 2 minutes

the other 3 were put on an hour test –

Length of Carbon 4.428 inch. Section ▭ .0045" x .005"

Leading in wire .0125"

Illuminating Surface .1107 square inches

" per candle .00692 sq. in

14. Incandescent Lamps — July 4th 1883.

All types entered and dated at time of entry.

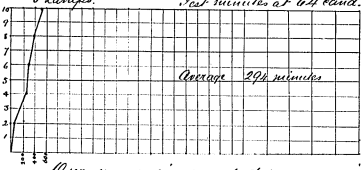
Date	Type	Lamp	Normal Candle	Size Carbon before Carbon"	Size Carbon after Carbon"	Illuminat Surface	Surface Candle	Life	Remarks
1883 July 4	Edison	A 16	16	6" x ·008" x ·017" 6·5" x ·008" x ·017"	4·75" x ·006" x ·011"		·0074		
" "	"	A 16	16	6·5" x ·008" x ·015"					
" "	"	A 32							
" "	"	A 10		5" x ·0065" x ·0012	4·25" x ·0045" x ·0065"				
" "	"	A 50		8" x ·013" x ·012"	6·19" x ·008" x ·017"				
" "	"	A 100		9" x ·012" x ·019"	6·2" x ·007" x ·0125"				
" 25	Siemens		100		7·575 x ·026	·6443	·00684	32	Bast.

15th Incandescent Lamps — Jly. 9th 1883. July.

Type Edison A 16 — Fabrication July 2nd 1883.

Before Carbonization 6" x ·008" x ·017".

5 Lamps. — Test minutes at 64 cand.



56
252
276
387
500
5) 1471
294

Average life 735 hours.

Our new engines and dynamos giving us so much more current and E.M.F. our men blackened all the lamps so badly that the majority of the first and second days run had to be thrown away. I arranged the machines so that they never had on the lamps more than 128 volts and these lamps were taken off when blue just going at that.

773 hours.

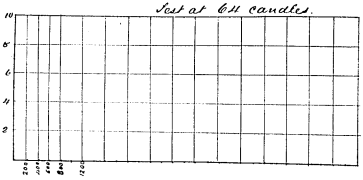
110

16 Incandescent Lamps Ivry July 12 1883

Type Edison A 16 Size of fibre before Carbn. 6" x ·005" x ·017

Electroplated only on clamp and carbon, none on platinum

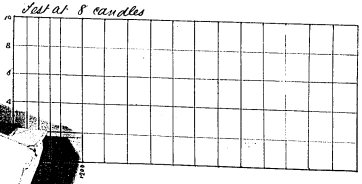
Test at 6H candles.



17 Incandescent Lamps Ivry July 12 1883

Edison. Fibre 5" x ·0065" x ·00925"

Test at 8 candles

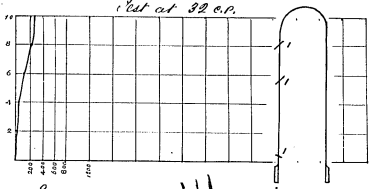


18 Incandescent Lamps Ivry. July 12 1883.

Edison. Fibre 5" x ·0065" x ·00925". 10 c.p.

Dipped before carbonization into a solution of half Sulphuric acid and half Nitric acid and washed perfectly:

Test at 32 c.p.



9
99
105
212
260
5)1260
123

145 hours

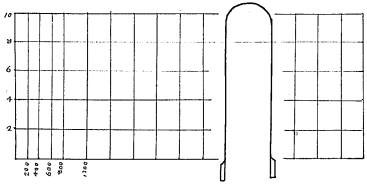
2 melted clamp.

Res hot.	207·8
Volts	108.
Amperes	·51
Resgrm.t	5.7
Lamp H.P.	13
Average life	312 hrs

19 Incandescent Lamps Ivry. July 12 1883.

Edison Fibre

Carbonisation very slow 24 hours.



20 Incandescent Lamps. Surv. July 14 1883.

Resistance lamps. In the washing room we have about 10% of these lamps. It is due no doubt to bad vacuum. 10 of these lamps placed at 16 candles gave an average duration of only

21 Incandescent Lamps. Surv. July 19. 1883.

Edison 8 c.p. Size fibre 3"x·008 x ·017

Tested at 32 c.p.

1 lamp	25 min.	Res. hot	72·13
1 "	25 "	Volts	57.4
1 "	121 "	Amp.	·79
1 "	475 "	Kilogrms	4·6
1 "	632 "	Lamp. HP.	16·2
5	1278	Aver. Life	637.5
	255 min		

112

668 hours

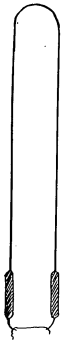
Peculiarity Carbonization 24 hours.

Remarks: Something wrong as long carbonisation ought to have reduced resistance & volts whereas this increases it.

22. Incandescent Lamps. Surv. July 25 1883.

Siemens 100 c.p. Life 32 hours.

	when first put up.	After 25 hours
Res. Cold.	42	44
" Hot	22.9	17.1
Volts	102	115.2
Amperes	4.45	6·73
Kilogrms	46.3	79.1
Lamps HP	1·6	0.9



113

After 7 hours glass quite discolored.

More black opposite positive pole.

Length of fibre 7·875 inches

Diameter " " 0·026 "

Surface of illumination ·6443 square inches

" " " per candle ·00644 sq. in.

Section D. I think it is a Bast fibre.

Leading in wires each pole 10, size of each ·007

Fibre broke as in sketch on positive pole no doubt by arcing. Clamps made of plumbago paste baked on

23. Incandescent Lamps

Sory. July 31 1883

Edison 10 c.p.

Size of fibre 6" × ·065" × ·00925" –

Set at 32 c.p.	
1	105 min.
2	375 "
3	390 "
4	673 "
5	762 "

Economy

	32 c.p.	16 c.p.
Resis. Cold.	180	
" hot	150	180·1
Volts	125	104·3
Amperes	0·69	0·54
Kilgm^{ts}	8·7	6·1
Life of Lamp	461 min.	
HP.	8·5	12·2

These fibres I brought from America. 536 Hours.

114

24. Dynamo Electric Machines

Aug 1st 1883

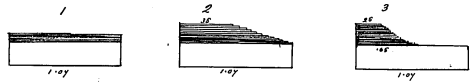
Sory Sur Seine

Type Edison –

Test to see the difference of Volts with 3 different kinds of winding of the same wire as shown in sketches 1, 2, and 3.

Rev.	Lamps	1	2	3
1200	0	131·2		139·
1200	60	112·5		122·5

115



6½ layers No 18 full length.

10 layers decreasing each up –

16 layers decreasing first 2. ·06 each and the rest ·03 each

24. Regulating devices by Resistances of German Silver –

Aug. 2nd 1883.

The table on next sheet serves to calculate regulators for any number of lamps. It is a table of all the necessaries for reducing the intensity of light in an Edison lamp from 16 candle power to a 'black.'

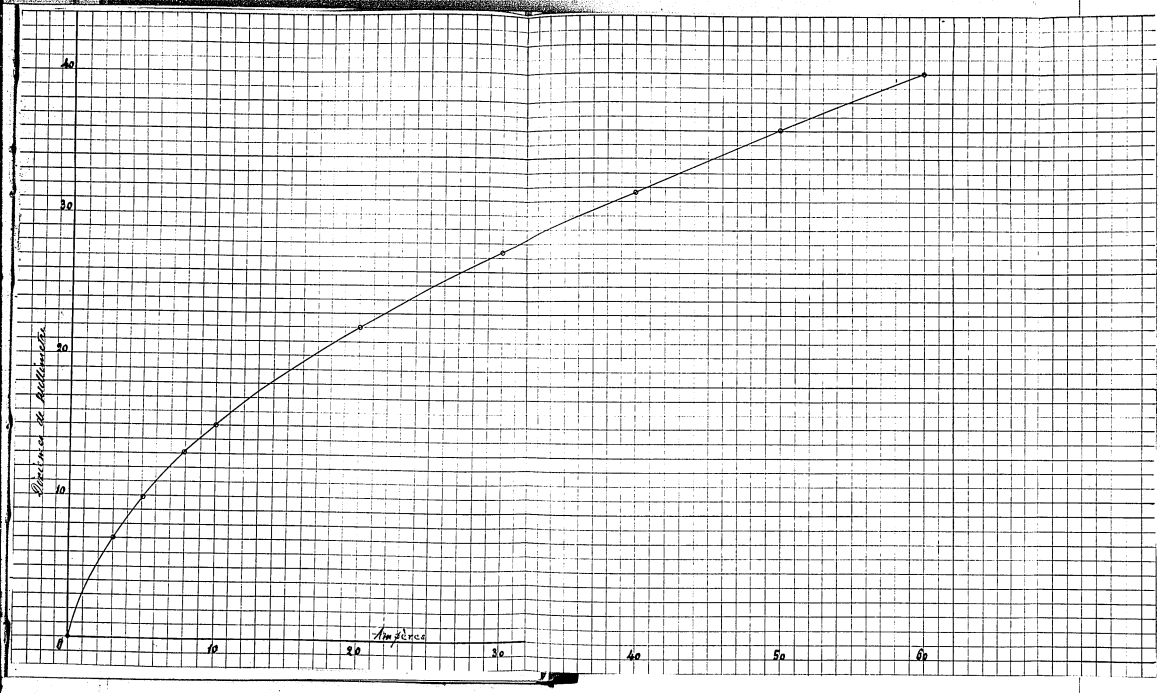
To find the diameter of wire :– Multiply the second column by the number of lamps this will give the Amperes then from the 'curve' find the diameter of wire in decimes of millimetres –

To find the resistance of such wire divide the 6th column by the number of lamps

116

Resistance to place in the circuit of a lamp A Edison type to bring from 16 candles to black.

	Amperes	Resi. totale	Resi. lampe	Resi. total	Resi. add reach
1	·7864	140.	140.	0	0
2	·7628	143·08	141·8	1.28	1.28
3	·7512	146·43	143·6	2·83	1·55
4	·7336	149·94	145·4	4·54	1·70
5	·7160	153·63	147·2	6·43	1·89
6	·6984	157·50	149.	8·50	2·07
7	·6808	161·57	150·8	10·77	2·27
8	·6632	165·86	152·6	13.26	2·49
9	·6456	170·38	154·4	15·98	2·72
10	·6280	175·16	156·2	18·96	2·98
11	·6104	180·21	158·0	22·21	3·25
12	·5928	185·55	159·8	25·76	3·55
13.	·5752	191·24	161·6	29·64	3·88
14	·5576	197·27	163·4	33·87	4·23
15	·5400	203·70	165·2	38·50	4·63
16	·5224	210·57	167·0	43·57	5·07
17	·5048	217·91	168·8	49·11	5·54
18	·4872	225·78	170·6	55·18	6·07
19	·4696	234·24	172·4	61·84	6·66
20	·4520	243·36	174·2	69·16	7·32
21	·4344	253·22.	176.	77·22	8·06
22	·4168	263·91	177·8	86·11	8·89
23	·3992	275·55	179·6	95·95	9·84
24	·3816	288·26	181·4	106·86	10·91
25	·3640	302·19	183·2	118·99	12·13
26	·3464	317·55	185·0	132·55	13·56
27	·3288	334·55	186·8	147·75	15·20
28	·3112	353·47	188·6	164·87	17·12
29	·2936	374·66	190·4	184·26	19·39
30	·2760	398·55	192·2	206·35	22·09
31	·2584	425·69	194·0	231·69	25·34
32	·2408	456·51	195·8	261·01	29·32
33	·2232	492·81	197·6	295·23	34·22
34	·2056	535·12	199·4	335·02	40·39
35	·1880	585·11	201·2	383·91	48·89
36	·1704	645·54	203.	442·54	58·63
37	·1528	719·81	204·8	515·09	72·55
38	·1352	813·61	206·6	607·01	91·92
39	·1176	935·77	208·4	726·97	119·96
40	·1000	1100·00	210	890·	163·03


40
30
20
10
0
10
20
30
40
50
60
Amperes

25. Dynamo Electric Machines. Aug 2 1883.

Type Edison

Made a 120 light machine keeping as near as possible to the dimensions and price as the old 60 lamp machine of Edison

Magnets: Diameter 205 m/m
length 720 m/m

Keeper:- sufficient metal to equal cross section of core -

Magnets wound with 47 Kilo No 16 B.W.G wire

Magnets in series; resistance total 42 ohms

Diameter core of armature 246 over wire 260

Length of core of armature 275

Resistance of Armature ·04 ohms

Wound with layers of * B.W.G.

12 wires No 19 once round

72 coils + 72 commutator blocks.

Total diameter Armature ·260

At 1260 turns work 121 lamps on we had still 108 Volts.

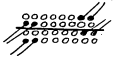
Each magnet core has 2148 metre wire -

117

26. Dynamo Electric Machines Aug. 10th 1883.

Type Edison

The Edison dynamo letter E running 2200 turns is objected to so I have designed it to run 1650 and still give its number of lights 17 A.



Original winding of the armature:-
Wire ·042" bare
2 Wires 8 times round.
Commutator 24 blocks.
Resistance ·35 ohms.

Present winding:-
Wire ·042"
2 Wires 12 times round
Commutator blocks 24
Resistance -

118

The core of the bobbin had to be turned down enough for the extra layers wire

The magnets were wound over again using paraffin and resin as in exp. 8 and the layers of paper taken out

When tested this gave at 1650 revolutions with 17 A lamps on at 16 c.p. each 110 Volts.

27 Incandescent Lamps. Aug 11. 1883.

Type Edison old style 10 c.p. Made Ivry 7-10 Aug -

10 Candles		16 Candles					
Resis Cold	Volts	Volts	Res.	Amp.	Kilg.	Lamp to HP	Remarks.
334	100	105	179.3	0.58	6.2	10.4	
333	103	110	193.4	0.56	6.3	11.9	
339	100	106	172.8	.61	6.6	11.3	
325	98	104	172.9	.60	6.3	11.9	
327	98	103	171.3	.60	6.3	11.9	
		Average					
		105.6	177.8	.59	6.3	11.4	

119

Size of fibre 5" × .0065" × .00925"

Above show economy at 16 candles.

28 Dynamo Electric Machines. Sept 12th 1883.

Type Edison L. altered to 180 lights

Magnet cores:- .520 long. .230 thick; each core wound with 47 turns No 16 wire

Head:- .650 long .290 broad .280 thick (deep)

Keeper:- .650 " .280 " .170 "

Line:- .080 high.

Armature:- 18 wires No 19 nice round

72 Coils — 72 Commutator bars

Wound like a B

Armature: Length of core .275 m m

Diameter of core .246 m m

Diameter total .265 m m

Sectional area of copper to carry the current

Sectional area per ampere of current

Resistance of Armature .03 ohm

Resistance of field 47 ohm. magnets in series

Test. 1200 turns

180 lamps. each 105 volts .80 ampères.

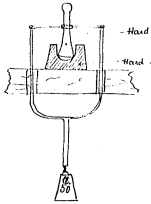
at 16 c.p.

Each magnet core has 2748 metres wire

120

Mortar for grinding diamond dust

Can be swung like a pendulum or moved by machinery ~~at top~~



29. Gas Motors — Paris Sept 18 1883.

Type Otto double cylinder — 8 HP. made at 232 Rue Lecourbe Paris. Test at same place

- Diameter of cylinders
  Stroke " "
  Weight of each flywheel
  Total weight of machine

This machine drove a countershaft and an Edison old 60 light machine with a load of 56 A lamps –

Load: 56 lamps 91 volts 100 ohms ·91 amperes.

Consumption per hour:– 7.004 gas
·360 litres water
½ litre oil –

Revolutions of Gas Motor 167
" " Dynamo 1154.

Useful work realized: –

Lamps. $C^2 \times R \div 9.8 =$ Kil.^{ms} – 473.
Magnets + resistance box 16·8
6·53 horsepower. total 489·8

Gas machine running with countershaft and dynamo without light uses 2.500 cm gas per hour
Ditto running with 20 lamps 16 candle power 5·373 per hour.

30. Incandescent Lamps — Sept 18 1883.

Edison 6½ × ·005 × ·0135 fibre. Lamps tested at Newark.

No		6 candles Time	Revs	Volts	Amp.	Watts	Watts per candle	Watts per cm		16 candles Time	Revs	Volts	Amp.	Watts	Watts per candle	Watts per cm	
923	N.Y.	117·5	119·3	2365	951	678	432	590									
926	N.Y.	120·5	125	5366	94	632	398	1178									
938	N.Y.	122·6	126·1	5117	979	635	406	1147									
941	N.Y.	123·7	121·3	4791	966	624	399	1734		100·4	139·5	3197	978	1034	165		
955	N.Y.	129·6	123	5747	1·06	574	377	1418		101·1	131·6	3066	970	932	159		
970	N.Y.	139·4	137·4	5633		564	374	931		106·8	136·4	3205		949	155		
971	N.Y.	137·4	136	6133		539	365	1611		110·8	133·8	3336		939	119		
	Fibre cut 6 × ·005 × ·014 same Watt																
951	N.Y.	101·6	15·2	5368	1·093	646	369	1041		81·3	93·7	3187	1·168	1035	169		
	Fibre cut 6 × ·0065 × ·00925																
		6.11 candles								10 candles							
95	N.Y.	120·7	124·1	2768	7·113	6·92	443	129		105·6	211·9	2418	4·96	1266	137		

122

31. Dynamo Electric Machine. Dorv. Sept. 24. 1883
Type Edison. Test to see what is the loss of volts when we widen the heads keeping the energy and mass of the magnet the same

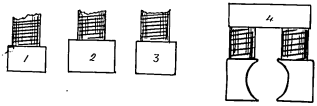
Dynamo E 2154 Rev. 109·8 V 4 lamps.
2098 " 106· 15 "

The same cores were now put on a magnet head of a Z machine and a Z bobbin run in it – the field was excited with a current having 106 volts same as before

this gave:– 1150 Rev. 68·4 V no lamps
1160 " 64·8 V 60 "

We now cut the heads so that they were the same width as in the E machine

1255 Rev. 73·8 V no lamps
1235 " 66·2 60 lamps 21 Amperes



A pair of cores were now made for 3 Diameter ·163 and length ·215 and same weight as in the first case 1 these were wound with the same wire that was on the E cores and same weight – this gave when the field was excited with 106 volts 106 volts. with 60 lamps

and 45 amperes. When the machine was allowed to excite its own field it gave:–

1200 Rev. 102 V 60 lamps 45 amperes.

This is the work done by the original Z machine but with the difference in weights as follows:–

Old Z 225 Kil in head 368 Kil cores 61 Kil wire
No 4. 177 " " " 68 " " 17·80 " "

Old Z. energy lost on field = $E I \div 9.8 = 110 \times 2.60 \div 9.8 = 29.3$ Kilg m
No 4 " " " " $110 \times 1.13 \div 9.8 = 11.73$ Kilg m

This experiment proves that the length of cores matters very little, but that the section makes all the difference, and I think that the maximum strength will be attained when the sectional area of the core is equal to the sectional area of the head on the side from which the lines of force are straight to the other pole or in other words is equal to the length and height of the "cutting" field. The wire used was the same as for an E machine and was $\frac{84}{100}$ and was 1665 metres long for each core, in the 1, 2, 4, 3 it was wound in layers but in 4 it had 19 layers each coil –

125

32. Dynamo Electric Machines Sat. Oct 1st 1883.

Type Edison – Economy of the 100 light machine.

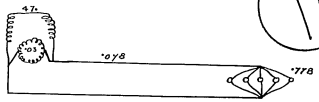
Good 100 lamps of 100 V and 140 ohm resistance.

Resistance of Armature ·03 ohms.

Resistance of Magnets 47 ohm

10% loss in conductors.

120 A



Resistance of lamps ·778 ohms

" " Line ·078 "

Energy:– In armature resistance ·03

Exterior $\frac{47 \times \cdot 856}{47 + \cdot 856} =$ ·84

Resistance total ·87

Energy in armature $\frac{3}{87} =$ 3·4 %

" " Exterior $\frac{84}{87} =$ 96·6 %

100·

Energy exterior 96·6 %

Line and lamps $\frac{47 \times 96 \cdot 6}{47 + \cdot 856} =$ 94·87

Magnets $\frac{\cdot 856 \times 96 \cdot 6}{47 + \cdot 856} =$ 1·73

96·6

Energy in Line and lamps 94·87 %.

Line $\frac{94 \cdot 87 \times \cdot 078}{\cdot 856} =$ 8.645 %

Lamps $\frac{94 \cdot 87 \times \cdot 778}{\cdot 856} =$ 86.225 %

94.87.

∴ Energy in the armature 3·4 %

" " Electro magnets 1·73 %

" " Line 8.645 %

" " Lamps 86.225 %

100.

Then for 1 H.P. or 75 Kilgm. we have (counting the conversion 90%:–

	Friction	7·50
Armature	67·5 × ·034 =	2·295
Magnets	67·5 × ·0173 =	1·16775
Line	67·5 × ·08645	5·835375
Lamps	67·5 × ·86225	58·201875
	Kgm	75·00

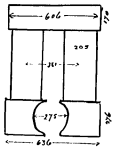
Energy per lamp $\frac{E^2}{K_J} = \frac{100^2}{140 \times 9 \cdot 81} =$ 7·28 Kgm.

$\frac{58 \cdot 202}{7 \cdot 28} =$ 7.993 lamps per H.P. including all losses.

9

33 Dynamo Electric Machines — Sory Oct 1st 1883

Type Edison — 300 light machine.



Magnet:- Diameter Cores ·205 } 4 in number
Length " ·720 }

Each wound with 47 Nil $\frac{16}{10}$ 11 layers.

Length of field ·560

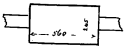
Armature:-

Length of core ·560

Diameter of core ·245

No of coils 54

Commutator blocks 54

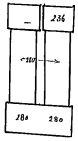


Wound with 12 wires $\frac{16}{10}$ once round

Resistance:- Magnets each 21·5 ohm.

Armature ·018

This same machine but the armature wound with 6 wires twice round will give 150 lamps with 450 turns

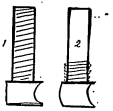


124

10

34 Dynamo Electric Machine — Oct 2nd 1883

Type Edison.



No 1 is a magnet core of a dynamo machine wound with 6½ layers of wire diameter 1·45 mm, the same machine as 60 light Edison —

When the same wire was wound round it in 16 layers as in No 2 for only a short distance of the core we only gained 10% of the volts —

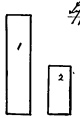
Now if the magnetic effect is equal to the depth of core × the current sent round it, the magnetic effect of No 2 ought to be much greater than No 1 — I always thought that we were very far from saturation point in our machines and it will be very necessary to immediately make characteristic curves of all the sizes

125

35 Dynamo Machine — Oct 2. 1883

Type Edison

11



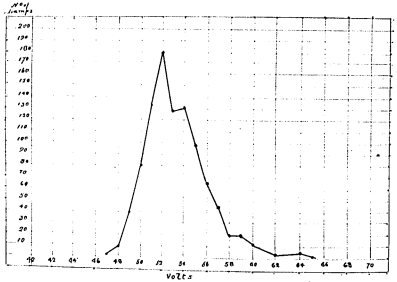
No 1 = Core. Diam. ·165 Length ·420
Wound with 30 Kilos of 1·2 mm.
in 18 layers of 633 turns
Resistance each core 4·5 ohm

No 2 = Diam ·165 Length ·210

126

35 Wound with 9 Kil. ·85 mm in 13 layers and 3207 turns. Resistance of each core 46 ohm Dynamo gave same volt at same speed in both these cases.

36. Incandescent lamps. Sery Oct 2 1883
Type Edison. Cut 3" x ·008 x ·0135 in fibre
Diagram of Volts required for the last 1000 lamps made.



29 Resistance lamps.

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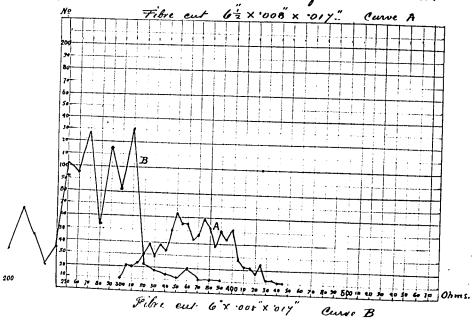
37. Underground Conductors Paris. Oct 2nd 1883
System Edison. Test to see how much current per ▨ m.m it is safe to put through them and their expansion –

These tubes were covered with earth and the ends A + B touched solid masonry so that any expansion would alter the distance between x x.
Length of bars of copper 6·100 metres
Section of each bar. 133 m.m. carré
Temperature of the room 13°·4 Cent.
A current of 411 amperes was now passed through the copper bars in the tubes. for 1 hour.
Increase of temperature of copper 14° Cent.
Increase of temperature of tube 21·5° "
Increase of length of copper bar ·001 m.m.
The insulating material almost commenced to run.
411 ÷ 133 = 3·1 amperes per ▨ m.m.

∴ For tubes having conductors with so great a section as this it is sure we must never put 3 amperes per ▨ m.m –

38 Incandescent Lamps. Sunny Oct 3rd 1883.

Type Edison Resistance cold of 1000 carbons.



39. Accumulators (Paris) Sunny Oct 22nd 1883.

System "de Meritand"

These experiments were carried on with 31 of these accumulators

Dimensions of Cells:-

30 plates each Cell

Each plate ·200 x ·300 x ·001 -

Each plate weighs

Surface each plate ·200 x ·300 x 2 = ·12 metre

Surface total cell ·12 x 30 = 3·600 metres

Total useful surface 3·500 metres

Total weight of plates

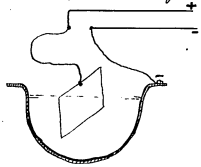
Weight of liquid

Total weight of cell

130

The outside cell was enamelled iron giving us a great deal of trouble with crosses -

Method of preparing the plates:-



The plates are oxidised or 'formed' by plunging into a bath of hot caustic Soda and Litharge and passing a current of about 200 amperes through it in about 7 minutes the plate is completely oxydized and ready for use

The negative plates must also be formed but much less time is required, about 2 minutes. For this also the disposition of the wires is changed and the + pole put to the boiler. On the plate there will be in about 2 minutes a pulverulent deposit (but adherent) of reduced lead

Proportions of the bath :-

Caustic soda dissolved & saturation in cold water 10 liters and litharge 2 liters

Quantity used about 100 liters

After coming out of the bath dip the plates in acidulated water (Sulphuric acid 1 water 10) this changes the color from red to puce.

In all these experiments we have discharged the cells through Edison lamps of 44 volts and when they have lowered in E.M.F. below this intensity we have disconnected & charged again

Diagram of charge

The charging was made by an Edison 60 light dynamo electric machine driven by a Gas motor.

No 1. Charged for 2 hours with 5 amperes and discharged with 10 amperes.

Charge	71 volts	5.2 Amp.	120 min.	-	270.972 Kgmt
Discharge	43.2 "	10.74 "	5 "		14.290 "

Rendement 5%

No 2. Charge 5 Amp. for 4 hours; discharge 10 amperes

Charge.	71.7 Volts	5.18 Amp.	240 min		545.183 Kgmt
Discharge	43.3 "	10.10 "	78 "		205.920 "

Rendement 37½%

In this case we commenced with 22 accumulators

In 27 minutes	"	23	"
" 38 "		24	"
" 47	"	25	"
" 54	"	26	"
" 60	"	28	"
" 70	"	29	"
" 77	"	30	"
" 84	"	31	"

The last cell was no good to us at all.

No 3. Charge 5 Amp. for 6 hours; discharge 10 amp.

Accumulators give 45 volts before charging.

T Charge	73.9 V	5.14 Amp.	360 min.		841.239 Kgmt
T'	43. "	10.05 "	98 "		259.025 "

Rendement 31 %

Commenced with 22 cells
after 20 min 23 "
" 38 " 24 "
then every ten minutes about 1 cell.
The last cell no good to us.

No 4. Charge. 5 amp, 8 hours; discharge 10 amp.

$T \quad \frac{76.0 \times 5.2}{9.81} \times 480 \times 60 = 1.172.160$ Kgm"

$T' \quad \frac{43.3 \times 9.9}{9.81} \times 137 \times 60 = 358.392$ Kgm"

Rendement 30½%

Commenced 22 cells
after 30 min 23 "
" 55 " 24 "
" 71 " 25 "

As on to 31 cells the last being no good to us.

No 5. Charge 10 Amp. 2 hours; discharge 10 amp.

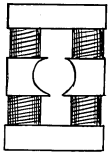
T 76.6 Volts 9.8 Amp. 120 min 550.800 Kgmt
T' 44.9 " 10.1 " 73 " 201.480 "

Rendement 36%

12

110 Dynamo Electric Machines Oct 22 1883

Machine no 4 of Experiment 31 was provided with two extra cores



Cores:- Diameter ·165
Length ·215
width of head of magnet ·195

Armature A:- Magnets in series.

950 turns	118 Volts	0 amps	
1150 "	110 "	60 "	

123a

Armature B.

1250 turns	10 volts	0 amps	Magnets series
1090 "	110 "	0 "	" " derivation
1170 "	112 "	60 "	" " "
1250 "	111	120 "	" " "

13

111 Dynamo Electric Machines Oct 22 1883

Type Edison E. changed cores. {Diam. ·165 {Length ·215

Ordinary:	1300 turns	110 Volts	0 amps
New Cores:	1200 "	110 "	0 "
	1300 "	115.6 "	17 "

Same wire in both cases:- 9 lbs each core
115 ohms resistance.

131

41 Life of Lamps Paris. Nov. 19 1883

Lyppe Edison. Hotel de Ville Plant.

From Oct 20th 1883 to Nov. 19th 1883. 500 lamps first key had 31.217 lamp hours. The reports give 29 lamps broken of which 20 are marked by accident and 9 'hors de service'.

31.217 ÷ 29 = 1076 hours average life.

The lamps in use are :-

A 16 candles

A 32 candles

B 8 candles.

132

42. Volts of Edison lamps under Nov. 19 1883

Column. No 1. A 16 fibre cut 6½" x .005" x .0135" ordinary 5 hours carbonisation.

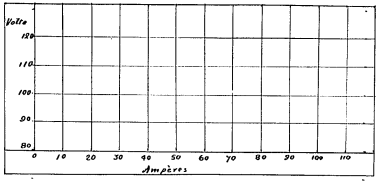
" " 2. A 10 fibre cut 6" x .0065" x .00925" 5 hr. Carbonisation

" " 3 B 8 " " 3" x .008" x .0115" 5 hr carbonisation

All above made about Nov. 12th 1883.

133

Volts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
35																			
40																			
45			21																
50			574																
55			350																
60			56																
65																			
70																			
75																			
80																			
85																			
90	21																		
95	122	5																	
100	266	18																	
105	162	170																	
110	153	305																	
115	107	255																	
120	73	125																	
125	67	81																	
130	37	22																	
135	3	18																	
140																			
145																			
150																			


Volts
120
110
100
90
80
0
10
20
30
40
50
60
70
80
90
100
110
Ampères

44. Frosting Solution for Incandescent Lamps.

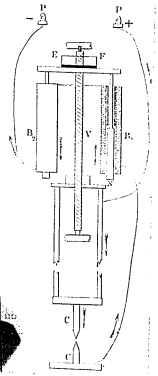
Paris Nov 30th 1883

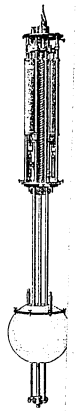
Make a mixture of Hydrofluoric acid and sal Ammoniac very thick, then take Sulphuric acid $\frac{1}{3}$ and this mixture $\frac{2}{3}$. Leave the lamps in for $\frac{1}{2}$ a minute and wash in ammonia water. 133

46. Arc Lamps.

Paris Nov. 21. 1883.

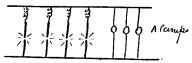
Type Cance.



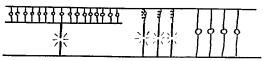


The Cance regulators require 57 Volts at the bind-post of the lamp with a minimum of 90 Volts at the Dynamo. The current must be 12 ampères for a good working. They will not light at less than 43 Volts and only commence to work good at 50 Volts. The dynamo must work very regular.

They work perfectly with our dynamos all the lamps being placed in derivation and each one having a resistance in tension to absorb the difference of E.M.F. between the dynamo and the lamp.



If the regulators are put in these conditions on the same circuit as the Edison lamps A they work very well and do not affect the good working of the incandescent lamps. The Cance lamp in that case is equal to 16 Edison A lamps of 75 ampères 134



On one of our dynamos giving 110 Volts I placed a regulator Cance which had its resistance replaced by 16 B lamps of 53 Volts and each of 75 ampères. thus giving the regulator 57 Volts and 12 ampères, other regulators were in circuit with their resistances and also some Edison

A lamps. There is no danger to the B lamps as the lighting of the regulator is exceedingly quick and is done before the B lamps come to candle power.

Under no condition would I connect this method of making an installation if the B lamps are intended for illumination; as in this case they will give a very variable light. An installation of this kind shows up the Cance light to perfection but at the expense of the Edison.

In cutting the Cance lamp on our system then, it must be placed there with its resistance and must be considered as replacing 16 lamps A of 75 Ampères.

The base of the Cance lamp acts as one pole, this I think is bad when we use it on our system, outside of this the lamp is well made and appears to regulate easily.

Cances circular gives:-

E.M.F. at Dynamo	75 to 80 Volts
" " " lamp	43 " 44 "
Resistance of circuit (Res. compound) cold	30 ohms 25
" " " " " hot	3 " 70.
Intensity of each circuit	6·5 to 7·5 ampères

The lighting power in this case then is 40 to 45 Carcels with a diffusing globe.

Price of an installation of 4 lamps.

4 lamps at 260 fr. each	1.040 fr.
Sabran for 4 circuits	72
4 circuits 100 m each	200
4 Rheostats	140
Dynamo Type d'atelier	1300.
Mounting	248.
	3000

or 750 fr. per lamp of 40 carcels
Larger installations 600 fr. par lamp.

46. Dynamo Electric Machines Paris Oct 1st 1883.

Type Edison H

The model as sent by Edison to Germany was as follows:-

Magnets:	6 cores
Connected:	3 pair in multiple arc.
Total resistance	9 ohms.
Size of wire No 16 B.W.G	·065"
" " outside insulation	·1
Weight of wire on each Core	65 lb.
Layers " " " "	8
Convolutions per layer about	312
Length of Iron Core	25 in
Diameter " " "	7 in

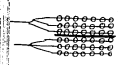
136

Armature:-

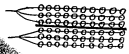
Length of face	30"
Diameter outside	10½"
" of iron core	9.16"
Size of wire BWG No 16	·065"
" " " outside insulation	·075"
Number of loops	1
No of wires per loop	44
No of commutator blocks	44
Space between armature and field	3/16"

Speed 1090
Amperes 413
Volts 105.5

To change this armature so as to give 55 Volts it can be wound with 21 wires No 16 once round and 44 commutator blocks. With this winding it will give 55 volts & 500 B lamps.



Or:- Wound with 30 No 16 wires once round with 30 blocks in the commutator and 900 Revolutions it will give 55 Volts and 730 B lamps.



47 Central Station Installations

Edison System in America—

Price complete of System in running order and worked 1 month

Town	State	Gas Lights	Contract Price	Price per 1 Lamp	Remarks
Mt Carmel	Penna.	500	$14000	$28	
Hazleton	"	1000	$20000	$20	
Bellefonte	"	500	$14000	$28	
Fall River	Mass.	1600	$40000	$25	
Newburgh	N.Y.	1600	$38000	$23.75	
Piqua	Ohio	500	$14000	$28	
Middletown	"	500	$14000	$28	
Lifin	"	1000	$18000	$18	
Williamsport	Penna.	3200	$54000	$16.87	

Dynamo Electric Machines

A Amps	Rev.	Electromagnet: Core Diam.	Core Long.	Each Weight	Per each Mach.	On Each Weight	Wire Diam.	Turns	Layers	Resis.	Total Diam. Cotton		Poles Length	height	Weight
17	2200	115	431		2		9/10	320	12½						
60	1200	16½	18¾		2		14/10	545	6½		192				
150	850	16½	18¾		4		14/10	545	6½		192				
250	900	16½	14¾		6		14/10	545	6½		192				
1200															
17	1650														
25	1600	14½	30½	38.6	2	8.9	9/10	250	22	90	150		200	140	60
50	1500	16½	35½	55		8.9	9/10	300	19	90			220	200	165
200	1200	23½	52½	170	2	47	16/10	275	15	4.5			280	280	225
500	750	23½	52½	170	6	47	16/10	275	15	15			880	280	700
120		20½	72½		2		16/10	290							
300 Series		20½	72½		4		16/10	290							
300		27¾	61½			70	24/10						457	278	
200		23½	61½			43	14¾/10						423	278	
50		15¾	54½			11.4	9/10						254	148	
25		12¾	66½			7	9/10						254	148	

Type Edison

Section Table	Armature: Core Length	Diam	Diam Entire	Wire Diam	No. of wires	No. of Layers	Comm. Bars	Resis.	Wt. Wire			Designer	
		113	126	10/10	2	8	24	.35				NY	
		246	266	18/10	6	2	74	.195	12			NY	
		246	262	16/10	6	2	54	.07	29.3			NY	
		246	265	16/10	10	1	64	.035	32.6			NY	
												NY	
												Sorg	
28000	216	113	128	12/10	2	9	32	0.42	6.5			Sorg	
44000	236	152	180	7/10	4	4	54	0.18	8			Sorg	
78400	304	246	265	16/10	8	1	74	0.49	33			Sorg	
246400	904	246	265	16/10	21	1	44	.016	78			Sorg	
		246	260	12/10	12	1	74	.042	15			Sorg	
		246	262	16/10	12	1	54	.0175	29			Sorg	
127046	456	246	266	34/10	4	1	48						
118150	419	246		16/10	10	1	64						
	253	125			2	7	22						
	253	125			3	10	22						

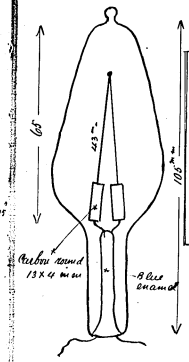
49 Dynamo Electric Machines Dec 17. 1883 Paris.
Type Edison. Batchelor design 200 Lamps. No 300
1160 Rev. 200 lamps 110 Volts
1160 " 0 " 110 Volts with ⅕ of
an ordinary Z regulator in series with the magnets

50 Incandescent Lamps Paris Jan 14 1884
Type Edison 10 candle power Cut 5" x ·0065" x ·0092"
Resistance cold of 1000 –

Ohms.	380.	400,	420,	440	460	480	500	520
No	70	80	220	140	190	265	50	35

135

51 Incandescent Lamps Paris Jan 14 1884
Type Gerard Test of two lamps numbered 23 and 30 at 8, 10, 12, & 16 candle power and life at 16.
Carbons a beautiful silvery appearance and quite straight.
Size of Carbons ·043 m/m, Diameter ·014" inches
Section ◎ round.



Economy

	23.				30			
	8	10	12	16	8	10	12	16
Volts	26	26·75	28·25	28·75	27	27·75	28·75	29·5
Revs hot	9·7	11·69	11·6	11·3	14·1	14·1	13·86	13·7
Amperes	2·65	2·28	2·43	2·54	1·90	1·96	2·07	2·15
Watts	7·1	6·2	6·99	7·44	5·22	5·54	6·06	6·46
Watts per HP	10·5	12	10·7	10	14·3	13·5	12·3	11·6
Res. cold.	21·6 ohms				27·9 ohms			

Life at 16 candles

No 23 80·15 hours
30 28·45
2) 108·60
average. 54·30 hours.

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52 Incandescent Lamps. Paris Jan 14 1884

Type Edison 16 candles Fibre 6" x .008" x .00135"

	Resistnt	Volts	Amp.	Kilow"	Air Cher.
16 Candles	133.8	100.6	.75	7.6	10.2.
64 Candles	123.8	123.3	1.	12.4	6

Life No 1. 70 minutes

2. 181 "

3 198 "

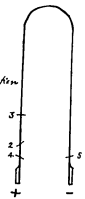
4 165 "

5 256 "

Σ 870

4.58 hours. 174 1 "

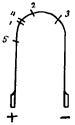
No 1 Glass broken



53 Incandescent Lamps. Surry January 22 1884

Type Edison. 8 candles Fibre 3" x .008" x .0135"

	N. hot	EMF	I	Kilow'	H.P.
8 cand.	78.11	38.5	.743	4.4	14.4
32 "	72.34	41.5	.985	7.1	10.6



Life 32 candles 1 5 minutes

2 110

3 141

4 483

5 13

Average 152 minutes 1100 hours.

54 Incandescent Lamps. Newark N.J. May 1883

Life at different E.M.F.

Volts at which lamps gave 16 candles

Time Hours	90	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
30	1000	1318	1731	2169	2945																
31	726	1026	1515	1724	2569																
32	671	746	1001	1510	1713																
33	446	673	746	1000	1500																
34	237	444	673	746	1000																
35	238	361	448	597	747	1000															
36	139	266	355	575	574																
37	123	205	266	348	465																
38	93	156	204	270	357																
39	92	123	156	204	273																
40		72	94	134	162	212															
41		55	73	96	137	166															
42		43	57	75	99	129															
43		34	45	60	77	101															
44		25	34	45	60	79															
45		21	28	36	48	62															
46		17	22	29	38	49															
47		15	17	23	30	39															
48		14	16	19	25	31															
49		8	11	14	18	25															
50		7	9	11	16	20															
111																					1000
112																					
113																					
114																					
115																					
116																					
117																					
118																					
119																					
120																					
121																					
122																					
123																					
124																					
125																					
126																					
127																					

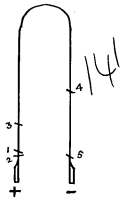
55 Carbonization. Sory Jan 22 1884

I took 50 fibres of 6½"x·005"x·0135" just as they come from the furnace and measured their resistance and found them vary from 510-760 ohms with a centre about 570. I then put them in the furnace again all together and all at bottom of a mould and they came out 305-415 with a centre about 335. The second time they were in the mould was in the hottest part of the furnace. It is necessary to take the resistance of all the carbons that come from a furnace and take notice of their position in the mould and the position of the mould in the furnace

56 Incandescent lamps Sory Jan 28 1884

Type Edison 10 candles Fibre 5"x·0065"x·00925"

	Resist hot	Volts	Amp.	Wtgm.	HP.
10 Candles	158·9	91·2	·595	5·6	13·2.
40 "	134·2	116·2	·701	10·2.	7·3



1 = 315 minutes
2 " 50 "
3 204 " Rev. 4·6 19
4 209 "
5 72 "
5/853 "
171 minutes average.

57 Incandescent lamps Sory. Jan 28 1884

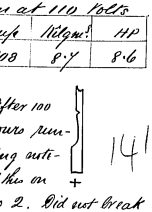
Type Edison A 16 candles Fibre 6"x·005"x·0135"

94 Volts lamps run at 110 Volts

	Resist hot	Volts	Amp.	Wtgm.	HP
16 Candles	103.2	94	·908	8·7	8·6

No 1 = 38 hr. 45 min
2 = 131 . 15
3 = 53 . 10
4 = 36 . 20
5 = 25 . 40
5/285 . 10

After 100 hours running with 110 volts on No 2. Did not break at that place.



57 - 2 average

58 Incandescent lamps Sory. Jan. 29 1884

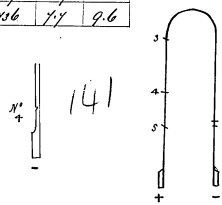
Type Edison A 16 candles. Fibre 6"x·005"x·0135"

Lamps of 104 Volts run at 110 V. Made Jan. 1884

	Resn hot	Volts	Amp.	Wtg^t	HP.
16 Candles	141.1	104	0·736	7·7	9.6

No 1 = 100 hr. 35"
2 = 26 . 54
3 = 11 . 50
4 = 191 . 58
5 = 50 . 35
5/381 . 55

76. 31 average.



59 Incandescent Lamps Surv. Feb. 13. 1884

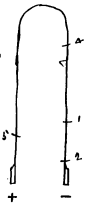
Type Edison Fibre 6" x ·008" x ·0135"

	Res. hot.	Volts	Amp.	Kilgm.	HP.
16 Candles	123.8	98	·79	7.9	9.45
64 "	114.15	121.1	1·059	13.05	5.68

At 64 candles 1 440 min.
2 126 "
3 13 "
4 82 "
5 217 "
5 848 "
176 Average.

Calculated on Edison's formula his would be Nr 159.37 min

No 3 platinum wire fused on negative pole.



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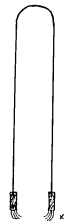
French glass.

60 Incandescent Lamp. Surv Feb. 13 1884

Type Siemens 16 candle power.

	Res. Cold.	Res. hot	Volts	Amp	Kilgm.	HP.
Commenced.	187	103.8	98.5	·94	9·5	7·8
50 hours.	187	103.8	98.5	·94	9·5	7·8
100 "	195	101·5	99.7	·98	9·9	7·5
150 "	195	101.6	99.7	·98	9·9	7·5
209 "	195	101.2	99.7	·98	10.	7·5

Duration 548 hours gradually got blacker



Length ·132 m m
Diameter
Section
Surface.

Platinum wires fused at x
Carbon intact but was loose in both holders.

142

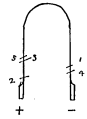
61 Incandescent lamp Surv Feb 22 1884

Type Edison Fibre 3" x 0,005" x 0,0135"

	Res. hot.	Volts	Amp.	Kilgm.	HP.
8 Candles	67.03	51.3	·766	3.93	19.5
32 "	61.59	63.	1.022	6.51	11.5

No 1 - 456 minutes
2 - 18 "
3 - 231 "
4 - 464 "
5 122 "
5 1291
258 minutes = 680 hours at 8 candles

145



62 Incandescent Lamps Surv. Feb 24 1884

Type Edison. Fibre 6" x .008" x .02½" Exper. 58

At 32 candles in normal intensity. Made Sept. 1883.

Resis hot	75.51 ohms
Volts	106.71
Ampères	1.361
Watts "	141.51
Watts for HP	5.1
Average life	107.21 hours

		for
1	190	45
2	13	35
3	44	
4	173	10
5	114	57

Two wires of platinum for each side of carbon or double hat for a 16 candle lamp

2. Copper + metallized

145

63 Resistance of Carbonisat. Surv Feb 24 1884

50 Fibres cut 6½" x .008" x .0135"

	Highest resis.	Lowest	Mean
5 hours carbonisation	800	525	640
Carbonised again all together in one nickel mould	500	350	410

144

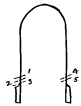
64 Incandescent Lamps Surv. Feb 28th 1884

Edison 16 candle B. 3" x .008" x .02½". Exp. 35

	Resis.	Volts	Amp.	Kilg.	HP.
16 candles	32.32	45.5	1.47	7	10.5
64 "	30.08	59.1	1.95	11.7	6.3

Made Mai 1883 - 1 = 303 minutes
Jan/84 2 = 136 "
Mai/83 3 = 288 "
" " 4 = 337 "
Feb/84 5 = 75

228 minutes average = 604 hours



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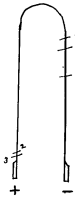
65 Incandescent Lamps Surv March 5 1884

Type Edison 16 candles A 6" x .008" x .0135" Exp. 63.

	Res hot	Volts	Amp.	Kilg	HP.
16 candles	115.78	95.6	.82	7.9	9.4
64 "	90.3	119	1.32	16.3	4.4

No 1. = 1048 minutes
2 = 285 "
3 = 68 "
4 = 497 "
5 808 "

Average 541 minutes or 1434 hours.
This is much better carbonisation.



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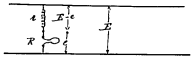
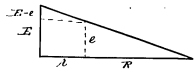
66 Incandescent Lamp. Paris. Feb 29th 1884

Economy of an Edison A 16 6"×·005"×·135" at different candle power. Resistance cold 213 ohms.





		Resistance hot		Amperes		
Candles	Volts	By Bridge	$\frac{EA}{E-e}=R$	Carpentier Ampermeter	Calculated by No 1	No. 2
1	63	138.93	126.8	0.41		
2	70	134.4	126.5	0.49		
3	74	132.26	127.3	0.50		
4	77	131.2	124	0.52		
5	80	129.6	125.7	0.55		
6	82	128.7		0.59		
7	84	127.8	119.2	0.60		
8	85	127.4		0.61		
10	88	126.2	121.3	0.62		
12	92	124.7	122.4	0.69		
16	95	123.3	121.3	0.71		
32	105	119.4	111.6	0.81		
40	108.5	118.9		0.85		
50	113	116.8		0.90		
64	118	116	92.9	1.00		

146

67 14 Dynamo Electric Machine Paris March 9 1884

Type (new) 100 A 16 candle lamp Designed Feb 20 1884

Armature:-

Iron core 250 × 148 m.m.

64 divisions

6 wires of 14/10 mm times round

Resistance — ·05 ohm

Magnet:- The 200 light machine has a section ratio of 56% and 34.16 amperes of current.

The old & 60 light 35½% section ratio and 18.34 amperes of current.

In this machine we will take as large a percentage of section as possible and also a heavy current.

With a core 250×150 m.m. and corners of 50 m.m. radius, we have a section of 35354 m.m. and the section of the iron of armature lengthways is 37848 m.m. Percentage $\frac{35354}{37848} = 91\%$.

I propose 27 amperes of current round the iron.

Length of magnet will be:- 283 m.m.

60 ohms resistance will be $\frac{110}{60} = 1.84$ amp.

1.84 × 15 layers = 27 amperes

then 60 ohms of 12/10 = 70.247 × 60 = 4214 metres.

or 2107 for each coil. $\frac{2107}{15} = 140$ metres each layer.

Perimeter of column with half layers on = ·789

140 ÷ ·789 = 177 turns.

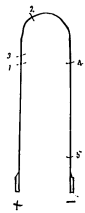
14

·0012 × ·004 × 174 = 283 Weight of core
Copper on the magnets
Copper on the armature
Total weight of machine

68 Incandescent Lamps. Surv. March 10 1884.
Type Edison A 16 Fibre 6" × ·005" × ·0135". Exp. 38
Fabrication March 1884

	Resistnt	Volts	Amp	Hpw	H.P.
16	113.5	96	·84	8·1	9·1
64	96·22	119	1·23	14·9	5

No 1 Pasted 383 minutes
" 2 " 161 "
" 3 " 170 "
" 4 " 55 "
" 5 " 1779 "
Average 509 minutes = 1319 hours.



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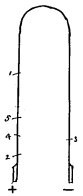
69 Incandescent Lamps Surv. March 9 1884
Edison. A 16. Fibre 6·5" × ·01025" × ·01025" Exp. 37.
Fabrication March 1884

	Resist	Volts	Amp.	Hpw	HP.
16 cand.	159·2	110	·696	7·7	9·7

Burns at 64 candles.
No 1 Pasted 400 minutes
" 2 " 805 "
" 3 " 317 "
" 4 " 197 "
" 5 " 347 "
Average 425 minutes = 1126 hours.



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70 Incandescent Lamps March 9th 1884
Cost of manufacturing Edison Lamps at Surry for the month of January 1884.

Fibres :- Material 107.40
Labor 557.85
General exes. 557.85
1223.10

₹1223.10 ÷ 19.816 fibres = ₹0.064 per fibre

Cartonnation :-
40.936 Fibres delivered 2619.89
Labor 463.35
General Expenses 463.35
3546.59

149

₸3546.59 ÷ 26.106 fibre carbonised = ₸0.135 for Carbon

Carbon testing:

22600 Carbon	3050.32
Labor	90.00
General Expenses	90.00
	3230.32

3230.32 ÷ 19.640 = ₸0.164 price carbon tested

Lamp ready for vacuum:-

Material	0.90
Labor	0.075
General Expenses	0.075
Lamp	1.05 ready for vacuum

Lamp after vacuum:-

15111 lamps	15577.90
Labor	1940.10
General Expenses	1940.10
	19448.10

₸19448.10 ÷ 13.617 = ₸1.45 price after vacuum

Sealing off:

Material	1.45
Labor	0.007
General Exp.	0.007
	1.4164

Plaster socket:

Lamp.	1.4164

Plaster & metals	0.125
Labor	0.43
Frais generaux	0.13
	1.8419 Lamp ready for testing

Testing:-

15265 lamps	28241.626
Labor.	450.00
Expenses	450.00
	29141.626

29141.626 ÷ 13.886 = ₸2.09 price of a lamp.

The percentage of loss then is:

Carbonising	36%
Testing Carbons	13%
Pump room	10%
Testing room	9½%

---

71 Incandescent Lamp Carbons Paris Rec. 10 1884

Shrinkage of bamboo fibre in carbonization - 150

100 fibre were measured with a thousandth gauge in three different places and the average of all was taken. The fibre was 6.5" x .008" x .0135"

Average measure	6.5" x .008032" x .013583"
Lowest	6.5" x .008" x .013"
Highest	6.5" x .0085" x .0139"

These were now carbonized and the carbons measured

measured with a thousandth guage in two places and an average taken. These varied from

$5\frac{3}{16}$ × ·0065" × ·009" &

$5\frac{3}{16}$ × ·0055" × ·008"

Average. 5·1306" × ·005828" × ·00865"

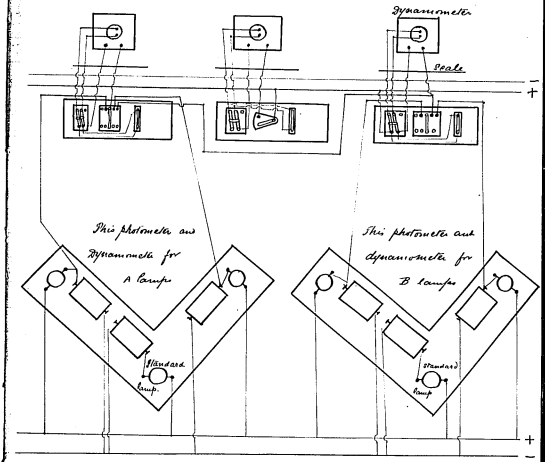
Shrinkage in length 21·15 %

" " width 36·32 %

" " thickness 27·44 %

7.2 Testing Incandescent Lamps. March 10 1888

Method at present employed at the Edison Lamp Co. East Newark. N.J. is shown in sketch they use a dynamometer for A lamps and another for B lamps besides one for testing the current on the line. This last is placed right across the line and the deflection upon its scale is kept constant by a man who watches it and controls the resistance in the 'field' of the dynamo. 75 volts on the B dynamometer produce the same deflection as 150 volts on the A dynamometer. The A dynamometer can be thrown across the line, and the B dynamometer is standardized by comparison with the A whenever used.



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73 Table of dimensions of fibres with their shrinkages during carbonisation Paris Mch 11th 1884

Fibre:-							
Normal size	6.5" x .008" x .0130"	6" x .008" x .0135"	8" x .015" x .032"	6" x .008" [illegible] .017"	9" x .012" x .070"		
Average size	6.5" x .00589" x .01355"	6" x .00797" x .01117"	8" x .01376" x .0323"	6" x .00793" x .01725"	9" x .01165" x .06775"		
Greatest width	.0052" x .014"	.008" x .0145"	.0328"	.0178"	.071"		
Least width	.008" x .013"	.008" x .0137"	.0316"	.0165"	.069"		
Greatest thickness	.0055" x .0135"	.008" x .0137"	.0135"	.0082"	.0125"		
Least thickness	.0075" x .0135"	.0078"	.0135"	.0075"	.0115"		
Average difference							
% difference width	+ 0.604 %	+ 0.697 %	+ 0.932 %	+ 1.47 %	− 0.32 %		
% difference thickness	+ 0.1125 %	+ 0.03 %	0.3	− 0.61 %	− 0.29 %		
Average carbon	6.125" × 5.522 / 1.65	11.6175" × .005438 / .003725	6.1875" × .00715 / .004775	11.6275" × .005576 / .010875	6.9375" × .00659 / .012143		
Shrinkage length	1.1875"	1.3125"	1.8125"	1.3125"	2.0625"		
" width	.004932"	.005472"	.011578"	.00640"	.026345"		
" thickness	.007706"	.002512"	.003778"	.002419"	.003665"		
% Shrinkage length	21.15 %	21.57 %	22.66 %	21.87 %	22.916 %		
" width	36.31 %	40.58 %	36.19 %	37.64 %	37.75 %		
" thickness	27.152 %	31.4 %	29.08 %	30.237 %	25.61 %		

52

74 - Carbons for Edison Lamps March 10th 1884

Carbons	Dimensions Length Inches	Dimensions width	Dimensions thick	Section in Sq. Ins	Surface in Sq. Ins.	Surface in m m per Candle	Candle power per sq. in of Surface			
5	2.	·0155	·005							
	1.553	·00849	·00573	0·03	35·55	7·11	·132			
	3.	·0235	·005							
8	2·333	·008 49	·00573	0·03	53·325	6·666	·15			
	3·25	·0135	·005							
8	2·5275	·00849	·00573	0·03	57·77	7·22	·138			
	3·	·017	·005							
8	2·333	·01069	·00573	0·038	61·573	7·572	·129			
	3·25	·017	·005							
8	2·527	·01069	·00573	0·038	66·791	8·34	·12			
	3·	·00755	·00665							
10	3·188	·00557	·00665	0·014	65·5	6·55	·152			
	6·	·00755	·0065							
10	4·666	·00557	·00665	0·014	98·6	7·86	·127			
	6	·0135	·005							
16	4·666	·00849	·00573	0·03	116·65	7·29	·137			
	6·5	·0135	·005							
16	5·025	·00849	·00573	0·03	115.50	[illegible]	·138			
	6	·017	·005							
16	4·666	·01069	·00573	0·038	123·15	7·7	·130			
	6·5	·017	·005							
16	5·025	·01069	·00573	0·038	133·4	8·34	·120			
	6·5	·025	·0165							
16	5·5	·0157	·01106	·112	[illegible]	[illegible]	[illegible]			
	6·5	·025	·0165							
32	4·666	·01695	·01086	0.0149	162·3	5·07	·197			
	7·	·017	·010							
32	5·1444	·01695	·00916	0·076	211·22	6·413	·157			
	6·	·017	·010							
32	4·666	·01695	·00916	0·076	181·	5·66	·177			
	7·	·021	·012							
12	3·11	·0132	·0086	0·07	109.	9·08.	·11			
	5·	·012	·012							
50	6·231	·0221	·0091	1·117	294·2	5·885	·169			
100	7·	·070	·012							
	7·	·0441	·0086	0·236	391·66	5·917	·169			

153

75 15 Newark May 16th 1884

Dynamo Machines. Type Edison. G 25 amperes.

Armature:- Length of iron 10⅛"
Diam " " 5"
Diam outside 5 7/16
Wire #19 ·042" Resis. ·297
" outside ·054

3 wires 10 times round with 22 blocks.

Field: 2 Cores. 19¾" × 5" weight each
6 #16 layers of #20 (·035)(·042) each
15 lbs wire each core
Magnets in Series total resi. 62 ohm
353 Convol. per layer

Test 10 hours at 25 amperes.
Speed 1839 Amperes 25 Volts at Dynm. 110
No sparking at brushes
Temp. of room 22° C
" " Armature 42°
" " Field 32°.

154

Total weight of machine 1072 lbs
" " of Iron in core, pieces & heads
" " of Copper on Armature & magnets
" " per ~~Ampere~~

76 16

Newyork May 17th 1884

Dynamo Machine Edison R 50 amperes.

Armature - length of iron 10 7/8"

Diam " " 5"

" outside 5 3/4

Wire #16 ·065 Resis. ·138

" outside ·085

2 Wires 7 times round and 22 blocks

Field 2 cores 21 1/4 x 6 1/2

wound with 8 1/2 layers of #20 (·035)(·049)

25 lb. wire each core

Magnet in multiple arc total resis 24 1/2 ohms

380 Convol per layer.

Test 10 hours at 50 amperes.

Speed 1595 Amp. 50 Volts at Dyn 110.5

" 1624 " 52. " " " 111

Sparking very slight

Temp of room 22° C

" " Armature 105°.

" " Magnets 55.5°

Weight of Machine 1187 lb.

" " Iron in cores fields & keeper

" " Copper on arm. & magnets

" per Ampere.

155

77 17

Newyork May 17 1884

Dynamo Machine Edison S 200 Amperes

Armature = length iron 16 1/2"

Diam. " 9 11/16

" outside 10 7/16

Wire #16 (·065) (·085) Resist ·022 ohms.

10 Wires once round and 64 blocks.

Field :- 2 Cores 21 x 9 1/4

wound each with 11 1/2 layers of #17 (·056)(·079)

94 lb. each core. Multi arc. Resis. 14.06

277 Convol. per layer.

Test 10 hours at 200 amperes

Speed 1206 Amp. 200 Volts 110.5

Sparking very slight

Temp room 22° C

" arm. 100° C

Magnet 51° C

Weight of machine 3821 lb.

" " iron in ~~cores~~ fields heads & keeper

" " copper on arm. & magnets

" per Ampere

156

48 18

New York May 17 1880

Dynamo Machines Edison T 100 Lamps

Speed 1490 Amp. 92 Volts on Lamps 109

" 1500 " 93 " " " 109.5

" 1520 " 95 " " " 112

Armature:- Length iron 13" = 330 m.m.

Diameter " 7½" = 180 m.m.

Diam. outside 8"

Wire #19 .042 - - - - 10 Wires 2 times round 60 block.

Total resistance .073 ohms

Field: 4 Cores each 5.7 ohms. connected in multiple arc and wound with 10½ layers of #20 (.035-.049) wire —

Weight on each core 25 lb.

Iron core 20½" x 5"

Test 10 hours

Temp room 27° C

" Armature 56°

Total Weight of machine ~~[illegible]~~ 1645 lb.

Weight of Iron cores fields & Frame

" of Copper arm. & magnets

" per Ampere

Price

Price per lamp of .45 ampere

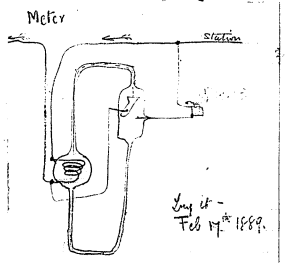
159

49 19

New York May 18 1884

Heating of journals of Dynamo machines.

I have frequently found that a dynamo machine will heat up on the commutator side bearing and not on the side of the pulley. This I believe is due to the following:- If the armature or shaft is out of truth it will make a rattling noise in the bearing and heat it up; in such a case the belt keeps a constant strain on one bearing & holds it steady against one side, the other end however is left free & vibrates & heats the bearing —



Inv it -
Feb 17th 1889.

80 DD

New York May 11 1884

Dynamo Machine Edison Y 300 lamp. Test made Nov 1881.
4 hours test.

1250 Rev. Amp. 288 Volts 111.5
1260 " " 288 " 110.
1330 " " 296 " 110.5

Armature. Iron 18" x 9 7/16" .457 x .246
Outside diameter 10 9/16 .276
Wound with 4 #10 wires once round with 48
Blocks. Resistance .011 ohms.

Field :- 2 cores 24" x 10¼" .609 x .275 --
Connected in Series & each wound with 8 1/4
layers of #13 & measuring 6.165 ohms
Total resi. 12.33 ohms.
Weight each core 150 lb.
Temp room 15° C
" Armature 69° C
Weight of machine ~~5000 lb.~~ 5450
" of Copper magnets & arm. field keeper & cond.
" " Iron field keeper & head
" per Ampere
Price
Price per lamp.

81 DD

Dynamo Machine New York May 21st 1884
Type Edison H 320 ampere
Test 5 hours
Speed 1060 amperes. 320 Volts 110
" 904 no load " 109.
Armature : Iron. 29 3/8 x 9 7/16 .746 x .246
Outside diameter 10 1/2" .266
Wound with 16 #16 wires once round with
44 blocks
Resistance .013 ohms.
Field :- 6 cores 25 5/16" x 7" .642 x .174
Wound each with 65 lb. 8 layers of #16
Resist each and connected as
3 sets of 2 in series in multiple arc
Resist total. 8.16 ohms
Temp room 29°
" Armature 64°
" Magnets 45°
Weight of machine 6999 lb.
" of Copper Arm. & magnet
" " Iron field cores & keeper
" " Ampere
Price
Price per lamp.

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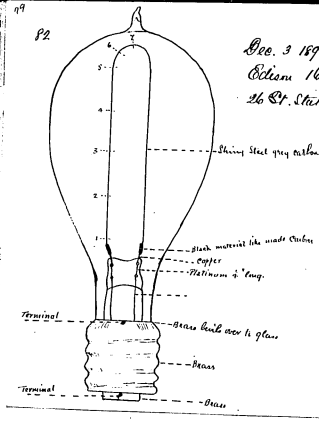
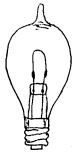


Dec. 3 1893 –
Edison 16 candle lamp as got from 26 St. Station Newport at this date
Very close to actual size

83



Dec 3 1893.
Edison 1 candle lamp for decorative effect. about 9 ohm in series for 115 volts according to brightness
Actual size (about).

84 Incandescent Lamp. Mch 1894

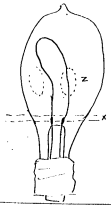
When a horseshoe magnet is presented to an incandescent lamp carbon through the glass whilst burning – one pole will attract the filament and the other repel it.

85 2. When a piece of sealing wax is passed before a burning incandescent lamp burner it has no effect but on rubbing the sealing wax with a silk handkerchief & then passing it before the carbon it causes it to vibrate strongly –

86 Incandescent lamp. blackening Mch 1894

An Edison 32 c.p. blackening pretty uniform but does not come below the dotted line x glass below that being perfectly clear; inside part also quite clear – carbon whole – lamp 9/10 fast

87. An Edison 16 c.p. slightly blackened, uniform except that a clear ring at x; the top of lamps in the middle of it, and also two clear places at z on one side & on the side towards which the carbon leans, carbon almost touches the glass Mch. 1894 carbon whole – carbon lamps.



1388. Edison 16 c.p. lamp blackening Mch 1894
Light blackening, uniform except light ring all round just above clamps, no blackening below the round part of inside part – carbon clamps – carbon not broke –

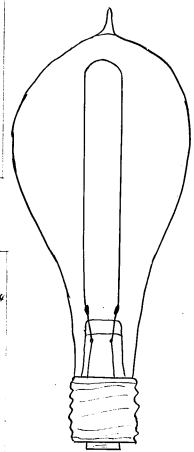
1389. Edison 16 c.p lamp blackening Mch 1894
No blackening below the top of glass inside part where corks come out – no signs of clear ring opposite clamps – carbon clamps – uniform blackening & slight – carbon not broken

1390 Edison 16 c.p. lamp – blackening Mch 1894
Slight – uniform – none below top of round part of inside part no signs of clear ring at clamps. – carbon not broken – carbon clamps –

1391 Edison 16 c.p lamp blackening Mch 1894
Slight – not uniform – none below top of glass inside part – no signs of clear rings – but large places on inside surface of glass where carbon has apparently refused to deposit – carbon broken ⅔ from clamp – The irregularity of the blacking in this lamp suggests the following as a cause: the glass bulb or the tube its made from (if so made) has been washed & the water has been greasy or not been pure and in drying something residual has been deposited on the inside of globe unequally & that the carbon will not adhere to it – another cause suggests itself – perhaps some parts of the glass have been in greater

tension than others & have made in cooling an exceedingly fine film of glass inside in some parts, that is separated from the main body of the bulb, & when the bombardment commences it wears away the loose glass & leaves that part clear – carbon $\frac{1}{2}$ apart –

1392. The present Edison 32 c.p. lamp. full size about.



1393 Edison 16 c.p. lamp blackening Mch 1894
Frosted lamp.

carbon not broken; but blacken very irregular same all round as shown in sketch – carbon clamps –

1394. Experiment to find out whether lamps blacken at a low temperature. Two 110 volt, 16 c.p. Edison lamps were put in series Oct 5 1894 10.17 a.m. and have been kept constantly burning as under:- The lamps have carbon clamps about 3/16" apart and each lamp is numbered 1 & 2. #1 Carbon straight & ½" apart except where it joins the clamps where it is 5/16". #2 Carbon crooked & in places wider than ½" but 3/16" wide where it clamps - ½ is larger bulb than #1 & should say 10 c.p. - both bulbs are quite clear.

Date	Time	No of hours	Remarks.
1894		hr. m.	
Oct. 8th	noon	73.43	No perceptible difference in color.
Nov. 3rd	"	673.43	#1 shows a little blackening on glass above the loop.
" 19	10.17 a.m.	1056.00	No more blackening.

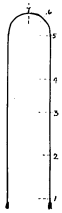
1395. An Edison 16 c.p. - carbon clamp - carbon broke at A - no black below top of inside part - blackening uniform except two clear parts of a ring just above the carbon clamps & on one side only - as if the bombarding from one clamp had prevented deposit on glass where it struck, and the other clamp being in path had protected that part of glass and allowed deposit - clamps 3/16" apart.

1396. Edison 16 c.p. - carbon clamp - carbon broken at 7 - no black below inside part top - blackening quite uniform - clamps 3/16" apart.

1397. Breakages noticed in Edison Lamps. All being new filaments and clamped to platinum with carbon paste.

C.B. Nov. 1894.

Date	1	2	16 candle 3	4	5	6	7	1	2	3	32 candle 4	5	6	7
Jan 1894	11	4	3		5	1	1	1			1			



1398. Screening Crushed Ore. Ore Milling Oct. 1st 1895

Dec 22. 1891. Tried capacity of screens for screening dry and wet. Ore from a stock carrying 1½% water 48% iron

Screen a 50 mesh steel screen with apertures ½" long.

Do. capacity 6" square, held at at an angle of 30° and given taps with a bolt. Ore had all passed through a 14 mesh sieve

Exp. 1 Took 3 lb. ore 1½" deep. 100 taps - Screen 50 - 100 Knocks wet screened 69.82 grammes

" " dried " 171.70 "

Exp. 2. Took 1 lb. 42" deep. 80 taps Screen 50 80 Knocks wet 9.44%

" " dried 28.0% Moisture 1%.

Exp. 3. Took. 100 gr. 40 Knocks Screen 50 - Moisture 1%.

110 Knocks wet 20.5%

" " dry. 41.8%

Same screen used for all 3 exp. & the slots in direction in which the Knocks were given

1396. Ore Milling Edison Iron process. Oct 1 1895

Dec 22. 1891 Size of ore after crushing and separating Ore broken, and passed successively through rolls of ½", ¼", and ⅛" and screened lastly through a 0.096" slot screen. (slots about ½" long)

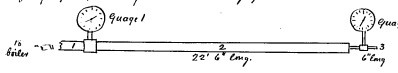
Dried some of this and took 1 lb. or 480 grammes.

and passed it through the following sieves (ordinary 6" circular brass wire cloth):-

Wont go through	14 mesh	180 gr	or	37½%	and of the			
rest " " "	20 "	120 "	"	25%	"	"	"	
" " " "	30 "	90 "	"	18¾	"	"	"	
" " " "	40 "	22 "	"	4 $\frac{58}{100}$	"	"	"	
" " " "	50 "	20 "	"	4 $\frac{16}{100}$	"	"	"	
" " " "	60 "	7 "	"	1 $\frac{45}{100}$	"	"	"	
" " " "	70 "	4 "	"	$\frac{84}{100}$	"	"	"	
" " " "	80 "	7 "	"	1 $\frac{45}{100}$	"	"	"	
" " " "	90 "	4 "	"	$\frac{84}{100}$	"	"	"	
" " " "	100 "	3 "	"	$\frac{63}{100}$	"	"	"	
	100 mesh	20 gr.	went through	4 $\frac{16}{100}$				

1397. Steam pressure - Drop of pressure Oct 1 1895

July 29 1893. Exp. 1. #1 is a pipe to boiler, #2 is an ordinary

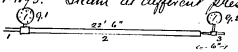


1" steam pipe 22' 6" long. #3 is an ordinary ¼" steam pipe 6" long. Guages #1 and #2 are set as shown in sketch. Boiler pressure 100 lb. #3 blowing off full - Guage #1 showed 95 lb., Guage #2 40 lb. - Drop 50 lb. or 52½%

Exp #2. A brass tube was substituted for #2 with ¼" hole in it the guages same distance apart and #3 same size

as #2. Guage #1 showed 95 lb. + guage #2 6 lb. a drop of 89 lb. or 94%—

Exp #3 Aug 1. 1893. Steam at different pressures but same pipes.



Boiler pressure	140	125	110	90	70	
Pipe # 1	½"	½"	½"	½"	½"	4" long
" # 2	1"	1"	1"	1"	1"	22' 6" long
" # 3	¼"	¼"	¼"	¼"	¼"	6" long.
Guage 1	134	119	106	85	64	
" 2	100	97	84	66	52	

Exp. #4 Aug 2 1893. Steam at different pressures but #2 a ½" pipe:

Boiler pressure	140	125	110	90	70
Guage #1	136	123	110	87	67
Guage #2	75	67	54	44	34

Exp. #5 Aug. 4. 1893. Ditto but #2 a ¾" pipe

Boiler pressure	140	125	110	90	70
Guage #1	121	113	104	76	48
Guage #2	70	72	64	46	34

Exp. #6 Aug 4 1893 Ditto but #2 a ¼" pipe

Boiler pressure	140	125	110	90	70
Guage #1	133	115	100	78	61
Guage #2	27	22	17	9	7

Exp #7 Aug 4 1893. Ditto but #2 a ¾" pipe and #3 was a pipe of brass with a ¼" hole in it

Boiler pressure	140	125	110	90	70
Guage #1	134	120	105	82	63
Guage #2	114	99	85	68	51

Exp 8. Dillo #2 is $\frac{1}{4}$" pipe and #3 brass tube with $\frac{1}{2}$" hole.

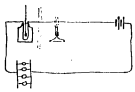
Boiler pressure	140	125	110	90	70
Guage #1	136	124	105	86	
Guage #2	58	50	41	35	

Exp. 9. Aug 8th 1893. Same experiments with compressed air:-

#1	#2	#3	Guage 1	Guage 2	Loss	
1"	1"	$\frac{1}{4}$"	75	65	13%	
1"	$\frac{1}{2}$"	$\frac{1}{4}$"	77	53	31%	
1"	$\frac{3}{8}$"	$\frac{1}{4}$"	75	42	44%	
1"	$\frac{1}{4}$"	$\frac{1}{4}$"	76	11	86%	
1"	$\frac{1}{8}$"	$\frac{1}{4}$" hole	80	34	57%	
1"	$\frac{1}{16}$" hole	$\frac{1}{4}$" hole	82	25	70%	

1898. Heat and Electricity. Nov. 26 1895

To observe the Thompson effect, I heated a wire which went into a bottle with a bunsen burner. Took temperature of inside of bottle. Had a screen between burner and bottle so as to get only heat by conduction. I passed the current of 4 Hop. Camps through the wire in both directions – Temp. C°



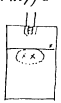
Minutes	0	3	6	9	12	15	18	21	24	27	30	33	36	
Current. Temp.	24	26	29	31.5	33.5	35	36	36.7	37.2	37.5	37.8	38	38	C. helps.
Reversed.	20.6	26.3	29.3	32	33.6	35	35.8	36.3	37	37	37.			Heating effect one way.

1399 Multipolar Dynamo as tested at Edisons Laboratory Dec 5 1888. (Optics)

16 Field bobbins in 5 series of 3 and one in extra circuit — making 6 circuits in parallel. Test from 7.40 p.m. Dec 5th to 7.0 a.m. 11th, and was interrupted twice to fix the brushes and take temp. on Arm. Surface. Voltage at terminals commenced at 130 & ended at 112. Current in field commenced at 62 amp. or 10.3 to the spool & ended at 47 amp. or 7.8 to the spool. Load began at 810 & ended at 760 amp. Total current therefore began 872 amp & ended 787. Total time of running 8 hrs. Highest temp. on arm. 260° Fahr. under cotton waste. Number of wires on the poles taking the load 20 averaging 140 amp. to each. The only failure in the test calling for improvement was the sparking at the brushes. This did not increase with the load & will probably be overcome by balancing the magnetizing power of the magnet coils. (This we are now doing Dec 29 1888)

1400 Phonograph Battery defects. (Feb. 1 1889) c

In the Phonograph Battery we use Carbon and Zinc — Mercury electrodes & a Sulphuric Acid Chromic Acid Solution — 7½ Chr. Ac. 15 Sul. Ac., 40 Water — Zincs are 10% Mercury at present. Long before the Zinc has entirely given out & in fact the first symptoms of its intention to do so, is a large occurring at X X. x is the line of the fluid. Sometimes the liquid tries to partially obviate this by lowering the Sulph. Ac to 10.



1401 Phonograph experiment. Wax Feb. 21 1889 c.

I tried for Edison an experiment on Doll waxes. I heated the wax just before the needle

to obliterate the previous record. We turned a wax with a hot iron, & we warmed up a piece of platinum wire & let it run just before the rec. knife. Result:- It would do it all right but it left the wax limpy & not true.

1402 Edison hurt. Feb 22. 1889 c.

MR. EDISON'S EYES IN DANGER.

A NARROW ESCAPE FROM SERIOUS INJURY BY AN EXPLOSION. 1889

Thomas A. Edison met with a severe accident on Saturday evening, of which the facts have just leaked out, despite the efforts of the laboratory employes to suppress them. He was engaged in making a chemical analysis, adding a strong acid solution to the substances under investigation, when, without the slightest warning, the mass exploded. The flames flashed up in his face, singeing his eyebrows and scorching his hair. Some of the acid struck him on the face and eyes and caused severe and painful burns.'

With great presence of mind Mr. Edison plunged his face in a basin of water and prevented serious injuries; as it was, his face and eyes were much inflamed and extremely painful on Sunday, but since then he has steadily improved and now shows but little traces of the accident. Those familiar with the facts say that he had a narrow escape from losing his sight.

Edison got hurt today whilst working on substitutes for fine tin carbons. He has been experimenting on these a great deal during the last 12 months with Kinney, Joe Force & Ripple. Now he has Freeman on it all the time in Room 4.

1403 Samples #8 collected Sydney C.B. Oct 1900 May 1901

Iron Ore from Bell Island, Conception Bay Newfoundland.

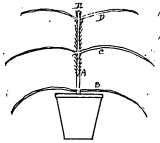
The Ore which the new Dominion Iron and Steel Co is going to use in their immense works at Sydney C.B.—

A hard rock that breaks up into cakes with square edges and covered with red oxide that paints everything red that comes in contact with it — Washed it appears as a black rock — Fracture under microscope shows innumerable flattened shaped crystals apparently hollow — Pounded in mortar shows these same crystals with much dust of a reddish color — Pounded fine all a decided brown — entirely non-magnetic — Microscope Slide #302 —

Araucaria Specimen

Dec 25th 1908

Dimensions when received :-	1908 Dec 25	Water: Oct 6 1909	Apl 21 1909					
						From Dec 25 1908 to Oct 6 1909 per day		2.83
Length of A from ground			5"					
Thickness of A $\frac{1}{2}$" from ground	$\frac{3}{16}$"							
Thickness of A 8" " "	$\frac{1}{4}$"							
Thickness of A			$\frac{5}{16}$"					
Hight of B (centre) from ground	$\frac{1}{4}$"	$\frac{1}{4}$"	$\frac{1}{4}$"					
Length of B from centre of A	$7\frac{3}{8}$"	$7\frac{1}{2}$"	$8\frac{1}{4}$					
Number of B in circle	4	4	4					
Hight of C (centre) from ground	$4\frac{3}{8}$"	$5\frac{1}{4}$"	$5\frac{1}{4}$					
Length of C from centre of A	$8\frac{1}{2}$"	$8\frac{1}{2}$	$8\frac{1}{2}$					
Number of C in circle	5	5	5					
Hight of D (centre) from ground	$8\frac{1}{2}$	$8\frac{3}{4}$	$8\frac{3}{4}$					
Length of D from centre of A	$6\frac{1}{2}$"	$7\frac{1}{4}$"	$7\frac{1}{4}$					
Number of D in circle	6	6	6					
Hight of E from ground	$9\frac{1}{4}$"	$9\frac{1}{2}$"	11"					
Length of E from centre of D.	$\frac{7}{8}$"	$\frac{7}{8}$"	$2\frac{5}{16}$"					



Water Dec 25 - Oct 6/09 71 days 2.83 from
Water Oct 6 to Apl 21 46 days. 4.83 pad.

Note 1. 71 days and 2 B of water each day does not seem to have made it start perceptibly growing but with 4 B of water and 146 days more the top E has grown 1½" and has now put forth buddings that look as if they were going to be branches Apl 21 1909.

Note 2. About Apl 25 1909 the top E formed into 5 little buds extending out of one rib; this seems to be the next branches F and the continuation of A – Note these branches are five in number like C whereas D is 6.
May 2nd These buds had grown until they are ¼" across

1909 99
Oct.

Arrival and departure of Steamship passengers each week end at New York

1909	First Class		Second Class		Steerage	
Week end	Arrival	Departures	Arrivals	Departures	Arrivals	Departures
Oct 17	1418	1715	5055	1449	31.619	3,732
" 24	1072	2096	4061	1900	25,093	4,783
May 1	1977	3603	4010	2568	29.612	5.056
" 8	1401	2134	4990	2863	22.944	5.345
" 15	1401	1979	4729	2615	28.932	6.476
22						
29	1529	3388	3545	3272	22.1195	7.045
June 5	1417	3262	5245	3906	25,308	6.299
" 12						
" 19	1663	4150	4044	3940	18.751	6019
" 26	1652	4594	4019	4615	15.932	6336

1909 Automobiling Accidents

No of Days	Date	Case	Where	What happened?		No in Car	Killed	In Other Vehicles Wounded	Damage	Killed	Other Wounded	Damage Damage	Causes - Death?
1	May 15	1	New York	Auto ran into milk wagon		3					1	All to Pieces	Careless Auto driving
	" "	2	Liege Belgium	Auto skidded against wall, killed 2, leapt over wall & struck passing train & killing Owner & wife — Trying to pass another	injuring 2	2	2		Car destroyed	2	2	Wrecking?	Carelessness.
	" 15	3	Woonsocket R.I.	Auto overturned		2	1	1	slight				
2	" 16	4	Salinas Cal.	Man found dying underneath his car		1	1		not given				
"	" 16	5	New York City	Pedestrian struck		1					1		Reckless fast driving
3	" 17	6	" " "	" "		3					1	Fractured Skull	" " "
"	" "	7	Greenwich Cr.	Pedestrian cannot off crossing track. Placed &	Killed 1 injured	2		1	slight				Accidental
"	" "	8	Williamsburgh Brooklyn	Man getting off a car, run down by auto along side							1	very serious	Fast running
"	" "	9	" "	Light wagon run into by an auto - tipped over	Man & man not						1	serious	Careless fast running
"	" "	10	Jersey City N.J.	Speeding - Turned on new Too Quick - Chauffer struck stone wall - his body hit another man	hurted not & broken nose -	2	1				1		Careless fast turning
4	" 18	11	Queens L.I.	Missing furniture van, ran into it, due to fad	places in road	5	Lost	all					
	" 18	12	Middletown N.Y. Warwick	Machine struck by Locomotive. Mr Barber an expert		1	7		Car destroyed				Man in back and machine Dived with him down track struck
	" 18	13	Paris France	To avoid a man, at high speed he swerved car which was	smashed	2		2	car badly smashed				Too fast for a road.
5	19	14	New York City	Auto went 2 drivers & chauffer, 8 Men & 1 girl — kept — Auto	Child ran into it running after	3					1	child dangerously injured	Seems the child's fault it might run any vehicle
9	" 23	15	" " "	10 yr old boy struck — running after ball —	Police Auto —	1					1	Ruined	Accidental
"	"	16	" " "	5 yr old boy playing toy struck by machine running	murder at city	2					1		Accidental
"	"	17	Elizabeth N.J.	(Auto skidded on Oil Slippy asphalt - Damage) Car &	Ground a tree	2						Damaged but only Two Killed	Fault to fast prevention
"	" 26	18	New York City	2 Men in Car fast speeding, Gas Lighter car struck off axle often nail and popping chickingauto, ran into street Chauffer Tore car out without screw driver — N.Y.H.T.	Breaking off axle Backward Street	2					1		Criminal fast driving
12	" 26	19	Pittsburgh Pa	Mower Tires 12 yr old Killed instantly — Chauffeur Hit, Man & Ist Starting up & boy Ran against it	and Kill people					1			Accidental
							5	4		3	12		

Automobile Accidents

Days	Date	Page	Where	What happened	No. in Car	In Car Killed	In Car Wounded	In Car Damage	Outside Car Killed	Outside Car Wounded	Outside Car Damage		Due 6?
12	May 26	19	Brought forward	12 days 19 cases.									
	May 27	20	Dubuque L.I.	Party of 5 – Steering gear became unmanageable & the car rammed a lot posts. Axles two broken – 1 Kill broken	6	5	4	15 car	3	12			
		21	Jersey City	Mr Aspinwall's car ran into a trolley car. – Trolley was	5		4	15 car					
		22	West Fork City	Morris Kipps 299 B'way. In Central Park at 59th St. wooden and hit a block su which a woman	about 4		3	15 car		1	Slight		
		23	" " "	Mr Chauffer Boy ran against car which had been	5					1	Slight		
	May 30	24	" " "	Boy stealing a ride on back of horse car, pumped off from	1				1				Accident
	" "	25	West Rochelle	Light Mr Mawbank, as he rounded a trolley car, two autos within at Struck him demolishing his rig, man badly hurt & horse also, the 2 Chas D. McPatten owner of car arrested	about 1					1			
	" "	26	Mid Dutchman N.Y.	attempting to pass another car ran into a ditch & turned turtle over, Body broken, deliverer of a knee, car took fire & burned	6		5						
	" "	27	Farmington L.I.	Auto detained by funeral attempted to pass, struck one of the Coaches	1					1			
		28											
	June 1	29	Stamford Ct	Auto ran down & killed 13yr old boy – driver arrested for manslaughter	2				1				
	" "	30	Chicago	Auto killed 1 children					2				
		31	Bridgeport Ct	Auto race. Man lost control. Car broiled over 6 people	1				1	4		Lost control & Lost control	

Automobile Observations

Date May 1895	12	13	"	14	"	15	"	16	"	17	"	18	19	"	20
No of Run	1	2	3	4	5	6	7	8	9	10	11		12	13	14
Weather	fine	fine	fine	fine	"	"	"	"	"	"	"		fine	"	"
Miles	142	21	30	14	37	17	15	19	54	6	32		21	31	15
Muffler R. front					2										
" R rear														1	1
" L front															
" L rear															
Pulley R front															
Belt R rear															
" L front	Tire exploded at 250														
" L rear	Tire exploded at 250														
Miscellaneous—Sprocket					1				1						
" Main Shaft Nuts												1			
" Spokes Nuts Broken															
" Water System															
Repairs in Run	5	3	5	2	5	3	5	3	5	4	5		3	5	3

Date May 1895	"	21	"	22	23	"	24	"	25	"	26	"	27	28	
No of Run	15	16	17	18	19	20	21	22	23	24	25	26		27	28
Weather	"	Damp	rain	Damp	fine	"	"	"	"	"	"	"	Wet	fine	
Miles	37	14	6	18	20	60	23	42	28	43	15	23		11	39
Muffler R. front												1			1
" R rear															
" L front															
" L rear															
Pulley R front														Broken Belt 25 Ru 2. 1895 M	
Belt R rear								1							
" L front															
" L rear															
Miscellaneous—Sprocket						1									
" Main Shaft Nuts															
" Spokes Nuts Broken															
" Water System															
Repairs in Run	5	3	4	4	3	5	3	6	4	5	3	4		3	5

Date	May 29	"	30	31	"	1	"	2	"	3	"	4	5	6
No of Run		29	30	31	32	33	34	35	36	37	38	39	40	41
Weather		fine	"	"	fine + clear		fine	"	"	"	"	"	Not fine	Not fine
Miles	733	10	65	26	26	38	20	30	10	38	14	33	1093 24	69
No of Persons		3	6	5	3	4	3	5	3	4	3	4	5	5
Punctures R front	2													
" R rear	4			1							1			1095 1
" L front														
" L rear														
Blowouts R front	2			1720 M Here				1707 5/16 M		Burst Here	1800			
Out's R rear	1		2								1151 1209 Apparently 5/8 M	Cobbles	Trouble	Blowout Miles M
" L front		Without a fault	1245 miles for use				1707 Here 1157 M			1795 Without trouble 5/8 M				
" L rear		Without a fault	1245 miles for use				170 Here 1157 M			1795 Without trouble 5/8 M				
Blowouts Other Causes	3													
" Mains Shaft Wheel	1													
" Speaking Tubes		1												
" Water System Leaking				1										
" Packing				1										1
Steering Gear													1	
Oil Can & Wrench														1
Gears & Chain Worn														
Battery														

Date	7	8	9	10	"	11	"	12	13	"	14	"	15	"
No of Run	42	43	44	45	46	47	48	49	50	51	52	53	54	55
Weather	fine	fine	Not fine	Not fine	"	fine	"	"	fine	"	"	"	"	"
Miles	9	19	9	19	10	14	26	1348 70	10	41	9	24	15	1090 32
No of Persons	4	5	4	5	4	3	5	5	3	7	3	5	3	
Punctures R front								2100						
" R rear														
" L front														
" L rear														
Blowouts R front	1970							2100						2309
Out's R rear	5/44 1656 M					Burst Here		792 1100						1056
" L front	1276 1970					Burst Here		467 2100						431
" L rear	175 1970					Burst Here		390 2100						654
Blowouts Other Causes	175					Burst Here		390						654
" Mains Shaft Wheel														
" Speaking Tubes	1													
" Water System Leaking														
" Packing		1	1	1	1	1	1						1	
Steering Gear														
Oil Can & Wrench														
Gears & Chain Worn														
Battery	1							1					1	

Press clipping was in general repairs days.

#32

Patrick Cooke Placentia N.F.L. Dec 6th 1902

Marked #1 B. — Information :- Has given 10 oz silver ⅔ oz gold —

Characteristics :- A hard white blue streaked rock — Spotted sparsely with what looks like very small specks of Galena —

Patrick Crotts Placentia N.F.L. Dec 4 1902. #1

Marked #1 B.S.- Information with samples - Has given 10 B silver ½ B gold —

Two dirty black pieces of rock one very much decomposed and much blackish brown dust from it - looks like volcanic —

One looks like hard clayey rock — both very easy broken

This is the blue clay piece #1

Patrick Creek Placentia N.F.L. Dec 4 1902 -
This is the Volcanic looking rock.

#34 154

Patrick Croke Placentia N.F.L. Dec 4 1902
Marked #1 X. He thinks them better than 32 + 33.

A creamy white hard quartz with blue coating on each side – Under the micro – one little spot seems to have a few few crystals of sulphide of iron

#35 156 8/62

Patrick Cooke. Placentia N.F.L. Dec 4 1902

Marked #2 X:- He thinks it better than 32 + 33

Blue slatey clayey soft rock — White streaks of quartz running through it — Microscope shows nothing

Dimensions of Edison Dynamos. as proposed Jan 1885 All measurements taken from actual Machines.

	Length	Width	Height	Weight		

Lamps. Edison lamps made Feb. 12th 1885
in Paris & rec'd in Newark N.J. for test June 9 1884

Order 731 Regular 10 C.P. lamps.

	Hours burning at 16 N.P. Candles	Watts	Hours burning at 10 C.P.	EMF	At 50 Candles Res.	Ft lbs	Amp.	Lamps per HP	Cand. per HP	EMF	At 10 Candles Res.	Ft lbs	Amp	Lamps per HP	Candles per HP
1	1·9	50	1779·9	133·5	201	9910	·598	7·61	379	113	233	24250	·49	11·47	135
2	4·3	45	2466·9	135	203	11135	·603	7·96	398	105.5	231	23250	·475	10·98	109
3	5·2	65	3354·6	101	206	12398	·455	7·73	387	111.5	229	27398	·411	13·93	139
4	4·3	70	4115·1	139.5	199	14640	·372	7·03	371	115.5	215	26273	·351	13·36	133
5	3·9	70	4184·1	140	193	15370	·373	7·30	365	115.5	215	26273	·351	13·36	133
6	5·7	70	4185·1	139.5	203	15250	·369	7·36	368	110	249	23355	·428	11·87	107
7	6·4	80	4784·8	138	196	17269	·465	7·70	385	101.5	219	23375	·419·5	11·89	119
8	9·1	95	5633·6	132	215	17640	·466	7·98	398	112	205	22250	·416	11·31	105
9	12·3	125	7461·3	135	193	21125	·578	8·00	400	100.5	207	29418	·530	14·95	103
10	14·5	155	8767	140	210	22370	·669	7·73	387	110	226	31560	·614	15·97	106
Av's	6·7	89	4984·1	140	202	17314	·496	7·7	385	109.7	227	23718	·419	13·92	119

Feb. 12th 1885

Lamps. Regular 16 c.p. lamps made at Paris
and received at Newark for test June 9 1884
Order 732

	Hours burning at 16 N.P. Candles	Watts	Hours burning at 16 C.P.	EMF	At 80 Candles Res.	Ft lbs.	Amp	Lamps per HP.	Candles per HP.	EMF	At 16 Candles Res.	Ft lbs	Amp.	Lamps per H.P.	Candles per HP.
1	0	0	0	139	123	4920	·113	10·75	860	108	101	3660	·765	9·03	144
2	·33	5	394·6	141	133	5325	·1060	5·06	405	112	238	3608	·755	9·09	152
3	1·76	15	1209	133	130	6070	·1061	5·11	408	109	108	3629	·759	9·11	146
4	3·25	35	2075·5	132·5	118·5	6175	·1015	5·34	427·1	101	139	3635	·760	9·66	154
5	4·19	45	2537·2	138	115	6110	·1113	5·15	411·9	100	132	3665	·766	9·23	137
6	5·75	60	3781	135·5	118·5	6610	·1234	4·89	391	102.5	130·5	3665	·765	9·24	143
7	7·57	135	8004·5	135·5	119	6150	·1101	5·36	429	101	130·5	3535	·732	9·24	137
8	12·35	145	8594·1	115	98	6300	·1255	5·12	410	98.5	102	3570	·745	9·36	150
9	14·65	160	9461·8	127	113·5	6305	·1123	5·34	427	99	123·5	3574	·700	9·41	151
10	19·15	235	13911·8	133	113	7335	·1401	5·65	453	94	133	3935	·770	10·37	165
Av's	13·06	97	5759	129·5	117·7	6361	·1149	5·41	433·4	101·5	131	3611	·706	9·49	152

Newport Feb 13 1885

Proposed Electric Motor for Sims Tied Torpedo.

Conditions:-

It must not exceed 400 lb. weight, over turn faster than 400 revolutions & give 10 HP. at the propeller

The electrical conditions (which are constant) of the circuit in which the motor must work are:-

Resistance of dynamo $\frac{1}{5}$ ohm

Volts at the dynamo 600

Resistance of the line 9 ohms

Armature:- Diameter of iron core 12.9"

" " " " end 12"

" " outside 13"

Length of iron core 19" or 480 m.m.

1 #15 B.W.G 8 times around

92 Commutator blocks

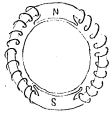
Total length of wire 3900 feet

" Resistance 1.93 ohms

Field:- Made of iron like ehated and 19" long.

Width of pole piece

Iron ½ thick 19" long and 1¼" of room on inner side for wire from pole piece to pole piece.



#10 131 B.W.G. 224 turns on each side.

2300 feet = 1.32 ohm. 368 spires on the Armature

118 spires on the magnet.

M.I. should be at 400 turns .23.

---

33 Feb 20 1885

Saturation of iron

Took a ring of iron 1" thick and 6½" long. and wound it lengthwise with 300 turns 126 metres of wire.

Pole pieces were 50% of circumference of armature

A Z armature placed in it at 1360 gave a cutting speed of per second

410 amperes saturates the iron. Total ampere spires 12000. How can this machine as a motor and get 41 amperes through it, at

12110 Revolutions

C.E.M.F. at brushes 67.3 V

C.E.M.F. 61 V.

---

34 Feb. 20 1885

Proposed Electric Motor for 2000 H.R. experiment—

Two motors to each car, one to each truck to drive by belt. Type Siemens

Armature:-

Iron length 18", Diam 11", bewitted to 10.8"

1 wire #9 B.W.G 3 times round

Speed 575. M.I. = ·745 meter second units
Field :- Iron 2½" thick 18" long - 45 □" section each
effective length in each of 11 sides 9"-
220 lb. "1/0 (·300) B.W.G. on the 11 cores, under the fine
wire but 106 lb. of "8 wire 11 in multiple arc - 23 turns
on each core
Armature resist. ·72 ohms about.
Field resist. thick wire ·0305 ohms thin 241 ohms.

Feb. 20 1885

Dynamo. 320 Ambers. Standard proposed.
Speed 1000. Volts 125.
Armature :- Iron. length. 20·5", dia 11". Sect. 10·68"
3 "4" B.W.G. one round 53 Comm Blocks
Resis. ·0041 ohms (about), weight of wire 87 lb.
Field 2 Cores. length 20", dia 12·75" eff. length 19"
160 lb. "11 B.W.G. ·085 on each core
M.I. ·348 N.S.U. at 1000 Rev. the drop in armature
% of effective block. 80%.

Feb. 21st 1885

Dynamo Municipal #2. Standard proposed.
Armature iron: length 20·5", Dia. 11", Sect. 10·68"
1 wire #11 B.W.G. ·12" 4 times round -
36 divisions 112 blocks

112 lb. of wire = ·455 ohms. HU. 750, Rd Sq. 780 □"-
nearly 1 HU per □".
Field :- Core length 20", dia 12·75" eff. length 19"
1140 lb. "21 B.W.G. ·032" on each core. total resis. 910 ohms
Amp spires, 26·500 about,
M.I at 1000 Revs and no drop in Arm. ·35 N.S.U.
Cores to be wound with heavy copper wire or sheet
next the core but insulated therefrom & present the
field being pierced of accidentally opened.

May 16th 1885

Electric Meter. First of Electric Meter for Semi fail
Experts. made as proposed in NO

At Dynamo	At Meter Brushes	Amp	Speed Meter
610 Volts	390 Volts	20·6	
610 "	380 "	23·4	700
620 "	340 "	24·4	695
500 "	350 "	25·11	696.8

Circuit external of Meter about 9½ ohms
At the last reading the solder on the brushholder melted
and brush fell off but did no damage - Field not
shunted. In a previous experiment we shunted the
field with a 50% shunt but saw no running up of
speed on the contrary the speed went down this is peu-
liar & will bear inspection - Add 3½ m. page
three orders further on

Electromotor. May 16th 1885

Proposed motor for about 3½ H.P. to drive at 300 rev. the transmitters put into 16 Broad St by Bergman & Co. for the Gold and Stock Tel Co.

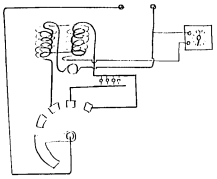
Armature: Length of iron 11". Diam of iron 6.375"

Diam. above bevelled 6.625" 34 division 65 Com. blocks, 1 "13 B.W.G. 295 5 times around. At 30 Amph. 600 c.c.c. in 20 Amp. Length Gaire 765 ft. Res 22. weight 21 lb. H.C. 131, Rad. Surf. 330 □", HV per □" 4. Mt. 363 w.s. Effective surf. arm. 80%. 30 Amp. - 6.6 volts drop in arm - 96.4 V Ecritta (not at brushes) - 2892 watts - 3.57 HP. deducting 10% for mechanical Inequalities - 3.3 HP.

When the series neutralizing field is in circuit the drop in arm. spiral will be more so 'ecritta' less but difference is little.

Field: Core 11" long, Diam 8.6". % of Section about 60% effective length 15". Its reverse series field "5 B.W.G. has 1½ layer on each core the ½ b b at bottom near the armature. Resis - .15 ohm. Its Shunt direct field "16 B.W.G 80 lb on each core has 160 lb 30 ohms. This wire goes at 103 V nearly 17000 Amp. spires 400 only want 11000. The speed would very likely be brought down to 250

Comm connected right across and half way round. Switch for vans as follows:-



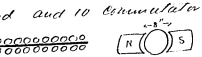
1st Stock nothing
2nd " Sub shunt field in circ.
3 " Sub arm. shunt field 4 lamps in series
4 Block Sub out lamps and leaves armature in circuit with series arm.

38 Dynamo Electric Machine. May 16th 1885

Change an old Z machine to give 1000 Amp and 5-7 volts. Proposed alteration.

Everything the same as an old Z as regards dimensions and arm wound with 16 "9 (ins) wires once round and 10 commutator blocks.

40 lb. -



Heavy brushes and holders and rocker arm fastens to base instead of bearing

Field to be run from another dynamo -

add better what is on following page 8½

Torpedo Motor. May 23rd 1885

Test of Motor as proposed.

Weight of motor 700 lbs Resist. { Arm. Cold. 2·07 ohm
Field " ·70 "

Volts at Generator 622.
" at brushes of motor 360
Amperes in circuit 27.

Armature resis. at end of run 2·3 ohms and here was 9·7 ohms in line. Since magnets measure 7 ohms this bare exactly 9 ohms in line outside of motors and generator. Speed of motor was 732. This would have been less but sparking necessitated keeping the brushes where it was least.

As HP future the motor was 360 – drop in armature X27 = 4895·5 watts = 10·58 HP. and we got effective on the propeller 9·27 H.P. We determined this in the following way:– the motor drove a dynamo which gave 141 volts and 35·3 Amp. + 3·71 amp in field & drop in it armature was 5·3 volts making a total of 146·3 X 39 Amp. = 7.65 HP.

In order to find out what was delivered to the generator, we took another dynamo exactly similar and put it in the torpedo motor's place and drove it as a motor, it driving the other one as before. When the generator was again giving 7.65 HP the motor absorbed 10·52 HP. making a difference between the two of 2·87 H.P.. Allowing ½ H.P. for each machine for friction there would be 1.87 HP to be accounted for as lost in

magnetic energy in reversing the armature. Since the volts in the motor were 170 & those on generator 146·3 and the magnetic losses vary as the magnetic intensity (speed being same on each) the intensity of motor to Gen. was as 170 : 146·3. The loss in mag. energy in Gen. was thus ·87 H.P.; to this must be added the ½ H.P. friction and 7.65 H.P. electrical making a total of 9·02 H.P. delivered to Gen. shaft. Add to this now ½ H.P. which would represent the difference a heavy belt and a propeller and you have 9·27 H.P. actually delivered.

We have decided to alter it & give more commutator blocks and do away with spark.

1000 Ampere dynamo. June 18th 1885

This machine designed No. – on being tested was found to heat up terribly. This I at first thought was due to the brush being so wide that it crossed two blocks for a long time so we had it cut off as at dotted line A – Not much sparking.

1 hours run with 500 amperes heated Arm. 25° to 104° C.
½ " " " 780 " " " to 120° C

When run in strong field without any brushes it heated up worse than ever, this was due to the winding which was ooooooooooooooooo the wire A having a greater potential than B when it is the stronger part of field there is a current tending to flow towards B and that causes a current in

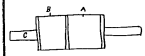
in each coil itself. We shall now change it to this

13 Heating in the Armatures. June 20th 1885

June 18th I took two #6 120 Amp. machines and put full load on one & on the other no brushes but the field charged. and took temp. every hour.

	Dyn. No 12 No load.	Dyn. 13 full load
Temp. of Room	29°C	
" end of 1 hour	44	
" " " 2 "	53	73°
" " " 3 "	58	82
" " " 4 "	63	87
" " " 5 "	65	88

Showing current heating effect small compared with other heating effects. On June 22d I took an armature core before winding and measured it from A & B and found ·4 ohm and from A & C ·3 ohm this I ran in its field with its face covered with tape & it heated in 4 hours to 40°C — Now I insulated the plates with 6 sheets of tissue paper after each 5 sheets of iron, (the iron sheets each having a tissue in between them) & this heated to 40° under same conditions. From this I conclude the Foucault currents are very small. The first 20° are probably due to the changes of magnetism as we



now use a field very much stronger than the old $\frac{1}{2}$.
The 20° between 40 & 60 are probably due to the difference of potential between the different coils of the same section and eddy currents
A 24 hour test of a #20 machine with full load on showed a heating up to 106 °c –

A #10 200 Ampère armature (bare iron) with no wire on heated when run in its own charged field:

Temperature commencing	20 °c
end of 1 h.	32 °c
" " 2 "	35 °c

The same when covered with oiled paper and black tape:

Temp. air	28 °c
after $1\frac{1}{2}$ hours	38 °c
" $2\frac{1}{2}$ "	40 °c
" $3\frac{1}{2}$ "	43 °c
" $4\frac{1}{2}$ "	44 °c
" $5\frac{1}{2}$ "	44·5 °c

Dynamo Electrical M. Aug. 2d. 1885
Constant Potential { 100 Ampere / 200 Volts } Lyte Edison

Proposed figures: Take #10 200 ampere model
Armature:- 1 #8 (·160") B.W.G. force round
66 commutator blocks Speed 1200.
Field:- Iron length 20·26"
220 lb. fine wire 52·5 lb of #5 on cores
Cores divided in two sections; upper section
$82\frac{1}{2}$ lb. of #18 B.W.G. + $37\frac{1}{2}$ lb. of #19 B.W.G. on each core; lower portion 6" wide 6 turns of # #5 B.W.G. in multiple arc

Aug 2 1885

Dynamo Lyte Edison designed.
Municipal #3. 1000 Volts + 30 Ampere.
Take Lyte #17. 240 Amp.
Armature length iron same; diam. 9 $\frac{11}{16}$" at level 9 $\frac{7}{16}$"; outside diameter 10·75" about.
Winding 1 #13 B.W.G. (·095") 4 turns round and 116 comm. blocks. 58 div. Wt. wire about 64 lb.
Resistance about ·68 ohm. H.O. same as 240 amp.
Magnets 250 lb. of #22 B.W.G. 125 lb on each core
Resist. 1380 ohms.

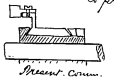
Dynamo Type Edison Designed. Aug 5th 1885
160 volts 240 amperes 1000 speed.
Takes everything of #16 320 amp machine except commutator & divisions

Armature:- 2 #.199 ones round. 70 Comm blocks. 70 div pieces. External dia same or perhaps ½ larger – Res. .0157 ohm – about 94 lb. – HV about 8% less than #16 –

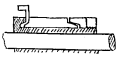
Magnets:- 160 lb of #15 B.W.G. (cyl) on each core – 320 lb in all – Res 110.5 ohm – HV will be extra less. about 10% less than #16.

Improvements in Commutators Aug 10th 1885

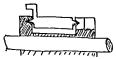
To prevent high bars



Present Comm.

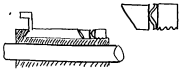


Edison suggestion



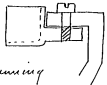
Mica in between bars & pack to bottom of shell.

Heavy steel spring to allow for expansion of bars.



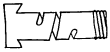
To prevent loose connections

Present clamp.



This cup would make better contact when running than when not, centrifugal force is favorable to it.

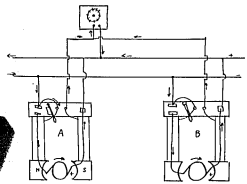
Cup and copper tongue fit into each other like a tap. Expansion has no effect on this



Steel commutator body cut to make a spring, to allow for expansion and contraction of the bar.

Sept 21st 1885

Phenomenon to be explained.



Chas Wm of Chicago says:- "the switch being opened at A in a few minutes B suddenly reversed the reversal being shown by the light running high-"
Speed of both same & unchanged.

Took two 160 amp dynamos & ran this way with a load of 150 amp. Field first connected above the switch. Broke A and volts fell from 125 to 116 & then rose back to 125 again. On closing A switch volts went up to 130 & fell back to 125. Broke "B switch volts went to 119 & on closing went up to 135 & fell back to 130 finally settling at 128 but not coming back to 125.
With field connected below the switch. Broke A volts fell from 135 to 125 and on closing quickly rose to 135 again. On breaking A switch again volts on B were 125 and volts of A went up to 157. On closing switch it seemed to take all the load for a moment and then the load divided itself again. It is evident that on some machines the volts may run considerably higher in proportion than the 160 amp. did and in that case a very heavy current would be

taken at first on closing switch not only from the load itself but from running the other as a motor.

Charles Batchelor Notebook, Cat. 1311

This notebook covers the period 1882-1883. Most of the entries are by Charles Batchelor. The book contains technical information and prices relating to Edison electric lighting equipment. Several printed tables have been pasted into the notebook. The book contains 54 pages, numbered by an archivist.

Blank pages not filmed: 19-20, 41-44.

CHARLES BATCHELOR.

E 5

Machines Dynamos (System Edison)

Désignation	Nombre de lampes de 16 bougies	Dimensions de la base	Hauteur totale	Poids. Armature et bobines	Poids. Bâtis	Poids. Base, socles et volants	Poids. Total	Poulie. Largeur	Poulie. Diamètre	Nombre de tours	Résistance ohms armature	Résistance ohms électros	Force en chevaux	Prix de vente
E.	15.	435 x 630.	830.	26.	200.	64.	290.	762.	127.	2200.	0,78.	90.	3.	1500.
Z	60.	1140 x 730.	1950.	125.	858.	247.	1230.	1524.	254.	1200.	0,15.	75.	10.	4250.
L	150.	1600 x 735.	1970.	250.	1506.	644.	2400.	2286.	355.	900.	0,07.	19.	20.	7250.
K	250.	1830 x 735.	2020.	340.	2258.	702.	3300.	2286.	355.	900.	0,062.	13.	35.	10250.
C	1200.	4266 x 2654.	2438.							350.	0,0042.	3.	150.	85000.

SOCIÉTÉ ÉLECTRIQUE
ROUSSEL
PARIS

Price list of Electric Light tubes

In New York June 1st 1882.

No of Size	Cost per foot	Cost per mile	Circular Mills per foot in each conductor	Sq. Millimeter	Weight per foot	Weight per mile
1	$4.05	$69.10	1.639890	830.	10.24 lbs.	
1 1/2	3.10	52.90	1.296419	658	7.95.	
2	2.25	38.40	862996	4444.	5.85.	
2 1/2	1.85	31.50	671562	340	4.12.	
2 3/4	1.50	25.60	494541	244	3.17.	
3	.80	13.65	262951	133.	1.60.	
4	.60	10.25	132886	92.	1.10.	
5	.45	7.70	107289	54.	0.66.	
6	.35	6.00	66581	33	0.40.	
7	.27	4.60	33015	16	0.21.	

ELECTRIC TUBE Co. Price.

Diameter inches	Ml	Ml	Copper wire Nos	Price	Coefficient Rating per 100 per foot	
3 1/2	92			$1.10		
3	76			17.6		
2 3/4	70			12.6		
2 1/2	65			10.0		
2 1/4	58			8.6		
2	51			4.9		
1.9	48			3.3		
1.35	33			2.9		
1.25	33			2.2		
1.	27			1.10		

Insulating Compound	10¢ lb.
" Tapes.	40¢ "

Tapes covered copper or cables

1 strand or single wire covered with 2 layers of tape.	50¢ lb.
2 " " wires together " . 2 . . .	47 ---
2 wires covered with 1 layer each separate & the two together after with 2 layers.	83¢ lb.
3 wires together 2 layers of tape.	45 --
4 " " " " "	43 --
4 " " 3 " " "	48 - -
5 " " " " " "	46 - -

FEEDER COVERING BOX

For	1. 1½. 2. 2½ & 2¾.		$2.90
"	3		1.92.
Joints # 1½	$2.70	Joints # 2¾	1.37
" # 2	2.25	" # 3	.75
" # 2½	1.94		

Service box	$ 2.15	Joints	$ 1.10
Cross box	4.32	"	2.04
Tee box	3.34	"	1.65
Elbow box	for # 2½ . 2. 1½ & 1.		2.80
" "	# 4 . 3. 2¾		2.38

Joints # 1½.	$3.27	The price for the boxes includes covers both plugs and board pieces that belong inside. — Without these the prices will be from 30 to 40¢ per box less.
# 2	2.50	
# 2½	2.04	
# 2¾	1.32.	

Elbow house box.

#3 box.	0.85.	Joints	$1.35
#4 "	.85	"	1.25
#5 "	.75	"	.55
#6 "	.75	"	.55
#7 "	.70	"	.50

House covering box

#3 box	0.90	Joints	0.56
#4 "	.90	"	.52
#5 "	.80	"	.45
#6 "	.80	"	.42
#7 "	.75	"	.28
#2¾ "	1.50	"	1.03.

House Tee Box, box any size from #3	—	$2.00
" " " joints " " " #3	—	1.50.

Height + Diameter of Stack for Babcock + Wilcox Boilers.

Actual H.P.	Diam.	Height	Actual H.P.	Diam.	Height
45	24"	60 ft	120	34"	80 ft.
~~54~~	26"	60	136	34"	80
62	26"	60	146	36"	80
73	28"	65	208	38"	100
82	30"	70	240	42"	100
92	30"	70	292	44"	100
104	32"	80	416	48"	125
			480	54"	125

Rankine Dynamo.

Magnet	88.	40	19	12.18					
Armature	30	14	19	.0325					
	E	Z	I	K	R	C			

Edison Dynamos & Machines

June 29 1882

Letter	No of Lamps	Rev.	Weight	Length	Width	Height	Diameter Armature	Diameter Pulley	Diameter Belt	Diameter Belt	Price
E	19	2200	700 lb.	2.1	1.5	2.2	5¾ x 3	8.00	.56		$700
Z	60	1200	1234 lbs	1143	.990	1829	10 x 6½	23.00	14	2000	$850
I	125	900	2150 lbs	1524	.990	1.982	14 x 9	8.00	.669		
K	250	900		1774	.990	1.982	14 x 9	8.00	.9325	2000.	$1350
R	500										
C	1200	350									$10,500
I	150	850 900.	2150 lbs	1524	.990		14 x 9				$900

Edison Lamps. June 1882.

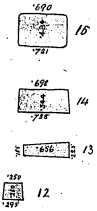
Candle Power	Res.	Volts	Main Amperes	Prim Volts		Length	Diameter	Diameter	
8	70	56	.80			3			
10	250		.50			5"	6½ / 1000	9½ / 1000	
16	140	103	.80			6"			
32			.160			6"	6½ / 1000	8½ / 1000	

Edison Light House Wire

No.	Area Cir Mils	Area Sq. Mm	Diam In. Mm.	Resis. 1000 M	Length per lb Sq. Mm	Weight per Meter	Diam 1000		
10	17956	9·098	3·40			18			
12	11881	6·02	2·76			16			
14	6889	3·5	2·10			14			
16	4225	2·14	1·65			11			
18	2401	1·216	1·24			7			
20	1225	0·6207	0·88			4			
23	625	0·3167	0·63						

"Boris"

1000 M Res.	1000 M Weight		



Gas.

Taking Gas at Paris as Standard
30d per cubic metre.–

Daily Extinction	Total Annual Lighting	Annual expense for daily consumption of				
		50 Litres	105	190	140	180
	for					
7	298.0	4.47	9.39	10.73	12.52	15.09
8	620.47	9.31	19.55	22.33	26.07	33.52
9	972.81	14.59	31.63	35.01	40.84	52.52
10	1337.21	20.06	42.53	48.14	56.17	72.22
1 hour Extra	365.0	5.49	11.50	13.14	15.33	19.71

For gas at 23d per cu. M. deduct 6d

Compound for tubes:
66.6% Asphalt Trinidad
8.4% Linseed Oil
15.% Resine
10% Parafin
This must never be allowed to rise above 320° Fahr. or 145° Cent.

Total Extinction	Monthly hour of lighting when lit according to need. Hours in											
	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec.
8	100	69	52	27	7	0	0	18	48	82	103	114
9	131	97	83	57	37	22	26	49	78	113	133	153
10	162	115	124	87	68	52	37	80	108	144	163	176

Bath for one m column
6 Kilos resin
2.4 Parafin

Safety cable leads.

For 3 lamps Kise of 50 centimm de Mill.

" 6 " " 75 " " "

" 9 " " " 105 " " "

" 12 " " " 140 " " "

" 30 " " " 260 " " "

Miles per Lb.	Knots per Lb.	Feet per Ohm.	Yards per Ohm.	1000ft. per Ohm.	Miles per Ohm.
[illegible]	[illegible]	19960·5	[illegible]	[illegible]	3·7815
0·0034259	0·0030047	17497·16	[illegible]·3833	17·4975	3·31195
[illegible]	[illegible]	13988·91	[illegible]	[illegible]	2·65025
0·0054124	0·0046948	11198·17	3722·7233	11·19811	2·12080
[illegible]	[illegible]	8718·39	[illegible]	8·71839	[illegible]
0·0077573	0·0067288	7813·56	2604·50	7·81350	1·47973
[illegible]	[illegible]	6198·14	2066·0466	6·19814	1·17371
0·0110457	0·0095813	5437·107	1812·3657	5·437107	1·03023
0·0012927	0·0011213	4688·51	1562·8391	4·68851	·887[illegible]
0·0015183	0·0013170	3991·91	1330·6365	3·99101	·756045
0·0018311	0·0016751	3138·59	1046·1961	3·13859	·59443
0·0022581	0·0019635	2657·99	879·0001	[illegible]	[illegible]

LENGTH

ster, Electric-Light Cable Makers.

COPY

WALTER T. GLOVER & CO. MANCHESTER

B.W.G. No.	Diameter. Inch.	Diameter. Millimètres.	AREA. Circular Mils. =d²	AREA. Square Inches. =d² × ·7854.	AREA. Square Millimètres.	WEIGHT AND LENGTH. Pounds per Foot.	Pounds per Yard.	Pounds per 1000ft.	Pounds per Mile. 1760yds.	Pounds per Knot. 2029yds.
0000	·454	11·5313	206116	·161883	104·435	·623924	1·871772	623·924	3294·32	3797·82
000	·425	10·795	180625	·141862	91·52	·54676	1·64028	546·76	2886·80	3328·13
00	·380	9·6518	144400	·113411	73·165	·437105	1·311315	437·105	2307·92	2660·66
0	·34	8·6358	115600	·0907922	58·573	·349928	1·049784	349·928	1847·62	2130·01
1	·300	7·620	90000	·070686	45·602	·272435	·817305	272·435	1438·46	1658·32
2	·284	7·2134	80656	·0633472	40·867	·244151	·732453	244·151	1289·11	1486·15
3	·259	6·5786	67081	·052685	33·989	·203058	·609174	203·058	1072·15	1236·02
4	·238	6·0451	56644	·0444881	28·701	·171465	·514395	171·465	905·333	1043·70
5	·22	5·5880	48400	·0380133	24·523	·14651	·43953	146·510	773·57	891·803
6	·203	5·1561	41209	·0323655	20·88	·124742	·374226	124·742	658·638	759·305
7	·18	4·5720	32400	·0254469	16·417	·098076	·294228	98·076	517·841	596·992
8	·165	4·1910	27225	·0213825	15·794	·082411	·247233	82·411	435·135	501·640
9	·148	3·7592	21904	·0172031	11·098	·066305	·198915	66·305	350·089	403·597
10	·134	3·4035	17956	·0141026	9·098	·054354	·163062	54·354	286·99	330·852
11	·12	3·0480	14400	·0113097	7·296	·04359	·13077	43·590	230·152	265·329
12	·109	2·7701	11881	·00933133	6·0190	·035964	·107892	35·964	189·893	218·916
13	·095	2·4130	9025	·0070882	4·573	·027319	·081957	27·319	144·245	166·292
14	·083	2·1082	6889	·00541062	3·4906	·020853	·062559	20·853	110·1001	126·935
15	·072	1·8288	5184	·00407151	2·486	·015692	·047076	15·692	82·855	95·5189
16	·065	1·6510	4225	·00331831	2·1407	·012789	·038367	12·789	67·5276	77·8486
17	·058	1·4732	3364	·0026421	1·7045	·0101828	·0305484	10·1828	53·7665	61·9840
18	·049	1·2446	2401	·00188574	1·2165	·00726796	·02180388	7·26796	38·3748	44·2401
19	·042	1·0668	1764	·00138544	·894	·00533972	·0160191	5·33972	28·1937	32·5029
20	·035	·8890	1225	·000962115	·6207	·00370815	·0111245	3·70815	19·579	22·5715
21	·032	·8128	1024	·00080425	·5188	·0030997	·0092991	3·09972	16·3665	18·867
22	·028	·7112	784	·000615753	·3972	·00237312	·00711936	2·37312	12·5301	14·4452
23	·025	·635	625	·00049087	·3167	·0018919	·0056757	1·8919	9·9892	11·5160
24	·022	·5588	484	·000380133	·2452	·0014650	·0043950	1·4650	7·7352	8·91804
25	·020	·508	400	·00031416	·2027	·00121082	·00363246	1·21082	6·39313	7·37029
26	·018	·4571	324	·000254469	·1642	·00098077	·0029423	·98077	5·17844	5·96992
27	·016	·4064	256	·000201062	·1297	·00077492	·00232476	·77492	4·0916	4·71698
28	·014	·3556	196	·000153938	·0993	·0005933	·0017799	·5933	3·13264	3·61143
29	·013	·3302	169	·000132732	·0856	·00051157	·00153471	·511571	2·7011	3·11393
30	·012	·3048	144	·000113097	·0730	·0004359	·0013077	·4359	2·30152	2·65329

B.W.G. No.	WEIGHT AND LENGTH. Feet per Lb.	Yards per Lb.	1000ft. per Lb.	Miles per Lb.	Knots per Lb.	LENGTH AND RESISTANCE. Feet per Ohm.	Yards per Ohm.	1000ft. per Ohm.	Miles per Ohm.	Knots per Ohm.
0000	1·60275	·534275	·00160270	·000303553	·000263331	19966·5	6655·5	19·9665	3·7815	3·28018
000	1·82895	·60935	·00182895	·00034639	·00030047	17407·15	5802·3833	17·40715	3·31385	2·87451
00	2·28777	·76259	·00228777	·00043329	·00037585	13988·04	4662·68	13·98804	2·64925	2·29802
0	2·85773	·9525766	·00285773	·00054124	·00046948	11198·17	3732·7233	11·19817	2·12086	1·83960
1	3·6706	1·22353	·0036706	·00069519	·00060302	8718·36	2906·10	8·71836	1·6512	1·43228
2	4·0958	1·365266	·0040958	·00077573	·00067288	7813·50	2604·50	7·81350	1·47973	1·28358
3	4·9247	1·641566	·0049247	·0009327	·00080905	6498·14	2166·046	6·49814	1·23071	1·06755
4	5·8321	1·944036	·0058321	·00110457	·00095813	5487·107	1829·0357	5·487107	1·03923	·90145
5	6·8255	2·275166	·0068255	·0012927	·0011213	4688·51	1562·8366	4·68851	·88797	·77025
6	8·0165	2·672166	·0080165	·0015183	·0013170	3991·01	1330·3366	3·99101	·756045	·6558
7	10·1962	3·39873	·0101962	·0019311	·0016751	3138·59	1046·1966	3·13859	·59443	·51562
8	12·1345	4·04483	·0121345	·0022981	·0019935	2637·29	879·0966	2·63729	·499486	·4326
9	15·0818	5·027266	·0150818	·0028564	·0024777	2121·84	707·280	2·12184	·401864	·34859
10	18·398	6·13266	·018398	·0034845	·0030225	1739·40	579·80	1·73940	·329432	·28576
11	22·9413	7·6471	·0229413	·004345	·0037689	1394·93	464·9766	1·39493	·264191	·22917
12	27·805	9·2683	·027805	·005266	·0045680	1150·91	383·6366	1·15091	·217976	·18908
13	36·6046	12·20153	·0366046	·0069326	·0060135	874·252	291·4173	·874252	·165578	·14363
14	47·954	15·98466	·047954	·009082	·0078781	667·338	222·446	·667338	·12639	·10963
15	63·7267	21·24223	·0637267	·012069	·0104691	502·175	167·39166	·502175	·095109	·08250
16	78·1902	26·0634	·0781902	·014809	·012845	409·276	136·42533	·409276	·077514	·067238
17	98·203	32·734	·098203	·018599	·016133	325·871	108·62366	·325871	·061718	·053536
18	137·590	45·8633	·137590	·0260587	·022604	232·585	77·52833	·232585	·04405	·03210
19	187·276	62·4253	·187276	·035469	·030766	170·879	56·95966	·170879	·032363	·028073
20	269·676	89·892	·269676	·051075	·044304	149·3915	49·797166	·1493915	·022475	·01405
21	322·610	107·5366	·322610	·061100	·053000	99·495	33·065	·099195	·018787	·016290
22	421·384	140·4613	·421384	·0798078	·069227	75·9461	25·315366	·0759461	·014384	·012477
23	528·570	176·190	·528570	·100108	·086836	60·54377	20·18125	·0605437	·011467	·0099461
24	682·55	227·5166	·68255	·129271	·11213	46·8851	15·62836	·0468851	·0088798	·0077025
25	825·883	275·2943	·825883	·156417	·13568	38·748	12·916	·038748	·0073386	·0063657
26	1019·61	339·870	1·01961	·193108	·16751	31·3859	10·461966	·0313859	·0059443	·0051562
27	1290·44	430·1466	1·29044	·244402	·21200	24·79873	8·266243	·02479873	·0046967	·0040740
28	1685·48	561·8266	1·68548	·31922	·27690	18·98653	6·328843	·01898653	·0035959	·0031192
29	1954·76	651·5866	1·95476	·370220	·32114	16·3710	5·4570	·0163710	·0031006	·0026895
30	2294·13	764·710	2·29413	·434496	·37689	13·9493	4·649766	·0139493	·0026419	·0022917

B.W.G. No.	LENGTH AND RESISTANCE. Ohms per Foot.	Ohms per Yard.	Ohms per 1000ft.	Ohms per Mile.	Ohms per Knot.	Resistance & Weight. Ohms per Lb.	Lbs. per Ohm.	B.W.G. No.
0000	·000050084	·000150252	·050084	·264443	·304861	·000080272	12457·5	0000
000	·0000571522	·0001714566	·0571522	·301763	·347886	·000104529	9566·7	000
00	·000071489	·000214467	·071489	·377465	·435158	·000163553	6114·21	00
0	·0000893002	·0002679006	·0893002	·471505	·543571	·000255196	3918·56	0
1	·00011470	·0003441	·114701	·60562	·698186	·00042102	2375·18	1
2	·00012799	·00038397	·12799	·67580	·779071	·00052422	1907·59	2
3	·00015389	·00046167	·15389	·81254	·936730	·00075786	1319·50	3
4	·000182245	·000546735	·182245	·962256	1·10933	·0010620	940·844	4
5	·000213287	·000639861	·213287	1·12616	1·29828	·0014558	686·911	5
6	·000250506	·000751518	·250506	1·32267	1·52483	·0020082	497·96	6
7	·000318614	·000955842	·318614	1·68228	1·93941	·00324863	307·822	7
8	·000379177	·001137531	·379177	2·00206	2·30805	·0046011	247·343	8
9	·000471289	·001413867	·471289	2·488405	2·86873	·0071079	140·689	9
10	·000574911	·001724733	·574911	3·03553	3·49948	·0105772	94·543	10
11	·000716882	·002150646	·716882	3·78514	4·36367	·0164462	60·8042	11
12	·000868875	·002606625	·868875	4·58766	5·28884	·0241593	41·392	12
13	·00114383	·00343149	1·14383	6·03945	6·96252	·0418692	23·8839	13
14	·00149849	·00449547	1·49849	7·91203	9·12132	·0718583	13·9163	14
15	·00199131	·00597402	1·99131	10·5142	12·1213	·12678	7·8872	15
16	·00244334	·00733002	2·44334	12·9008	14·8726	·191045	5·2344	16
17	·0030687	·0092061	3·0687	16·20274	18·6792	·301355	3·31835	17
18	·0042995	·0128985	4·2995	22·7014	26·1711	·59157	1·6904	18
19	·0058521	·0175563	5·8521	30·8991	35·6217	1·09596	·912445	19
20	·00842703	·02528109	8·42703	44·4947	51·2953	2·27254	·44003	20
21	·01008116	·03024348	10·08116	53·2285	61·3640	3·25229	·30748	21
22	·0131672	·0395016	13·1672	69·5230	80·1480	5·54848	·18023	22
23	·0165170	·0495510	16·5170	87·2096	100·539	8·73058	·11451	23
24	·02132874	·06398622	21·32874	112·616	120·828	14·5570	·068691	24
25	·025808	·077424	25·808	136·265	157·092	21·3142	·046917	25
26	·03186144	·09558432	31·86144	168·229	193·941	32·4863	·030782	26
27	·0403246	·1209738	40·3246	212·914	245·456	52·0367	·019217	27
28	·05266892	·15800676	52·66892	278·092	320·596	88·7724	·011265	28
29	·0610834	·1832502	61·0834	322·521	371·815	119·401	·008375	29
30	·07168825	·21506475	71·68825	378·514	436·367	164·462	·0060804	30

WALTER T. GLOVER & CO., 25, Booth Street, Manchester, Telegraph Wire and Cable Makers.
WALTER T. GLOVER & CO., 25, Booth Street, Manchester, Electric-Light Cable Makers.
WALTER T. GLOVER & CO., 25, Booth Street, Manchester, Electric Wire and Cable Makers.

PURE COPPER weighs 555lb. per Cubic Foot. The Resistance of one mil-foot at 60° Fahr. is, according to Dr. Matthiessen, 10·32311 Ohms. Upon these data the above Table has been calculated. The *Resistance* of Copper varies with the Temperature at about 0·38 per cent. per degree Centigrade, or 0·21 per cent. per degree Fahr.

1 Mil. = ·001 inch.
Diameter = d.
Sectional Area in Circular Mils. = d².
Area in Square Inches = d² × ·7854.

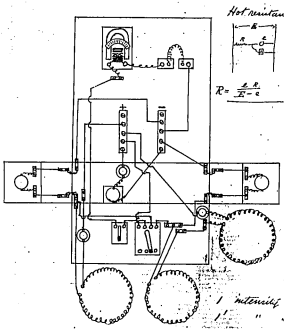
To convert:
- Inches to Millimètres multiply by 25·3994
- Feet to Mètres " ·3048
- Yards to Mètres " ·9144
- Miles to Kilomètres " 1·6093
- Pounds to Kilogrammes " ·45359

1 Statute Mile = 1760 yards or 5280 feet.
1 *Knot* or Nautical Mile = 2029 yards or 6087 feet.
1 Admiralty Knot = 2026⅔ yards or 6080 feet.
1 Statute Mile = ·86742 Knots.
1 *Knot* or Nautical Mile = 1·1528 Statute Miles.
1 Admiralty Knot = 1·1515 Statute Miles.

STRANDED WIRES.—A *Stranded Conductor* of a given length is of *greater weight* and has a *less resistance* than an equal length of the same number of wires *unstranded*.

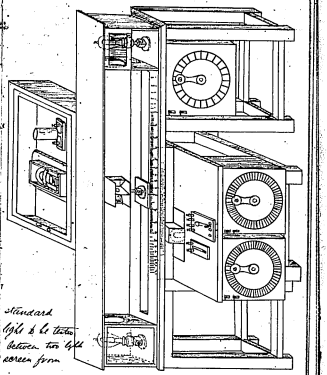
ENTERED AT STATIONERS' HALL ...
Issued by WALTER T. ...

Lamp Testing Apparatus.



Hot resistance

$R = \frac{A\,B}{D - C}$



Connections.

Scale for Photometer. Position of Screen for any candle power

$I : x^2 :: I' : (d-x)^2 = \quad \therefore \quad x = \frac{d\sqrt{I}}{\sqrt{I} + \sqrt{I'}}$.

I intensity of standard

I' " " light to be tested

d total distance between two light screen from

x distance of standard

Chaudières Belleville

Types	Prix	Long.	Largeur	Haut. nécessaire	Chauffe	Production horaire vapeur à 8 bars
A 3	6400	1m.810	1m.475	3m	2H	360 kg
A 4	7650	"	1m.685	"	3H	500 .
A 5	9000	"	1m.885	"	4H	650 .
A 6	10500	"	2m.105	"	5H	165 .
B 4	10450	2m.460	2m.085	3m.660	5H	825 .
B 5	12600	"	2m.335	"	7H	1050 .
B 6	14400	"	2m.585	"	8H	1275 .
B 7	16200	"	2m.835	"	10H	1500 .
C 5	18500	2m.860	2m.865	4m.260	11H	1725 .
C 6	21000	"	3m.175	"	13H	2100 .

Chaudières à 1 foyer de Belleville à Gleaux

Nom	Chaudière		Chaud. de la vapeur		Foyer		Cheminée		Ventilateur		Bâtiment		Bâtiment surélevé		Bâtiment surélevé		Total	
A 6	4	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7
A 5	4	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
A 4	5	5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
A 3	6	7	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
B 7	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
B 6	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
B 5	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
B 4	7	7	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C 6	8	8	1	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7
C 5	8	8	1	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7
Total	6	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7	1	7
Moy.	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Moy.	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Moy.	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Moy.	6	8	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Chaudière à 2 foyers de Babcock & Wilcox.

Pression	Dectivre		Surface de la chaudière				Poids	Surface		Amplitude		Poids	Poids	Prix
	Tubes	Long	Tubes	Diamètre	Long	Long		Long	Larg	Tube		intérieur	extérieur	
90	8	7	0,256	2	7,62	7,38	0,038	18,608	5,715	5,715	0,076	15,700	2,900	4,88 — 9,700
102	"	8	"	"	"	"	0,057	10,515	"	"	"	18,000	3,100	" — 10,333
114	10	8	"	"	"	"	"	158,76	"	5,715	"	16,000	3,500	4,71 — 11,675
108	12	7	0,254	"	"	"	0,076	18,104	0,381	0,203	"	11,000	3,000	2,13 — 13,350
102	"	8	"	"	"	"	"	19,04	"	"	"	13,500	3,500	2,54 — 11,200
111	"	9	"	"	"	"	"	20,412	"	"	0,152	19,000	3,700	2,49 — 12,933
128	"	9	0,32	"	9,14	9,00	0,076	23,587	0,381	"	"	20,000	3,500	2,79 — 15,233
240	18	"	"	"	"	"	"	25,253	"	5,977	"	41,000	3,950	3,38 — 19,033
292	18	"	"	"	"	"	"	28,123	"	0,152	"	32,500	4,100	3,71 — 21,033
292	24	7	0,254	2	7,62	7,38	0,10	34,475	0,381	0,305	0,152	44,000	4,000	4,08 — 24,700
116	"	9	0,32	"	9,14	9,00	0,076	42,638	0,711	"	0,152	38,000	3,500	3,49 — 31,833
116	38	"	"	"	"	"	"	48,938	"	0,305	"	28,500	4,700	6,31 — 38,500

21

Cheminées Toisoul et Fradet

Chevaux	diamètre intérieur	hauteur au dessus du toit	Cubes
20	0m 50	20	30.000
20	"	25	40.000
30	0,55	25	50.000
30	"	30	70.000
40	0.60	"	80.000
50	0,70	"	100.000
60	0,75	"	110.000
70	0,80	"	120.000
80	0,90	"	130.000
90	0,95	"	140.000
100	1	"	150.000
100	1	40	220.000
200	1,55	"	290.000
300	1,65	"	300.000
400	1,80	"	325.000
500	2	"	350.000
600	2.20	"	365.000

60 francs par mètre cube

22

Cheminées en tôle Babcock et Wilcox

Chevaux	diamètres	hauteurs
45	0m 61	20
51	0,66	"
62	0.66	"
75	0.71	"
82	0.76	"
92	0.76	"
104	0.81	25
120	0.85	"
136	0.85	"
146	0.92	"
208	0.97	"
240	1.06	30
292	1.12	"
416	1.22	40
480	1.37	"

55 francs les 100 Kilos

23
24
S
V
S'
STEEL PIN

Moteurs Weyher et Richemond.

Nos	Force en chevaux Nominale	Force en chevaux Maxima	Poids net Mi. fixes	Poids net Locomobiles	Prix à Pantin Mi. fixes	Prix à Pantin Locomobiles
1	4	5	1900	2400	4400	4800
2	5	7	2400	2900	5100	5500
3	7	10	3000	3600	7000	7500
4	10	14	3700	4300	8200	8800
4/5	12	16	4100	4800	9800	10400
5	15	22	4800	5500	11000	11700
6	20	24	6200	7000	13500	14500
7	25	32	7300	8000	16000	17200
8	35	50	10500	"	22000	"

Machines Armington

Introduction en 1/100 de la Course	TYPES	A	B	C	D	E
	CYLINDRE	[illegible] X 2032	215 X 254	241.3 X 304.8	"	330.2 X 330.2
	Dimensions de la Machine	990.6 X 2133.6	1108.4 X 2286	1422.4 X 2540		1574.8 X 3149.6
	PRIX	3380'00	4420'00	6240'00		10400'00
	Nombre de tours	F. C.	F. C.	F. C.	F. C.	F. C.
20	300 350	5.04 9.4	17.18 20.05	25.74 30.00		52.2 60.96
30	300 350	12.09 14.1	25.77 30.07	38.61 45.		78.3 91.44
40	300 350	16.12 18.8	34.36 40.1	51.48 60		104.4 121.9
50	300 350	20.15 23.5	42.95 50.12	64.35 75.		130.5 152.4
60	300 350	24.17 25.2	51.54 60.14	77.22 90		[illegible] 182.8
70	300 350	27.2 32.9	60.14 70.17	90.09 105		182.7 213.3
80	300 350	32.23 37.6	68.72 80.19	102.9 120		208.8 243.8

Machines Cotlios.

Nom des machines	Force en minutes	Chaudières maximum	Chaudières minimum	Prix à contentement	Prix tout contentement
0	75	20	30	12000	11000
1	70	30	45	16000	14500
2	60	40	60	17000	15500
3	54	60	90	23000	21000
4	50	80	120	30000	27000
5	50	120	170	40000	35000
5 bis	48	150	220	45000	40000

Remise de 5% sur tout cet prix

Résumé des devis d'installations Edison

Notes on Dynamos.

Class	Section View of Devis	No. of Lamps A	No. of Lamps B	Dia. of Pole Core	Effective Length of Armature	Outside Diameter	Sq. Inches of Wire Surface	No. of Divisions	Average Res. of Armature in Ohms	Average Res. per Minute	Average Foot Speed per Min.	Size of Wire Bare	Size of Wire Covered	No. of Loops	Wires per Loop	Cir. Mils per Loop
Volts 110		15							.36					8	2	3528
F				4 3/4"	8"	5"	125 □"	24		2200	2800	.042	.057			
55			30						.09					4	4	7056
110		60							.14					2	6	10,584
G				9 11/16"	11"	10"	345 □"	24		1200	3140	.042	.057			
55			120						.056					1	12	24,168
110		150							.069					2	6	25,350
L				9 11/16"	22"	10½"	726 □"	54		850	2340	.065	.095"			
55			300						.017					4	12	50,700
110		250						64	.032					1	10	42,250
K				9 11/16"	30"	10½"	990 □"			900	2560	.065	.095"			
55			500					32	.008					1	20	84,500
110		350														
H				9 11/16"	30½"	10½"	1006 □"	54	.021	1200	3300	.065"	.095"	1	12	50,700

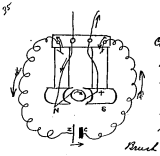
May 1st 1883. The Edison Elect. Light Co. N.Y.

1000 B 34800 " 36900 " 1.22 1.60 " 2.37 "

Résumé des devis d'installations Edison

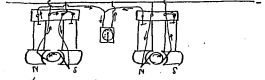
Installations		Matériel électrique — Usine — Frais fixes	Matériel électrique — Usine — Frais variables	Matériel électrique — Canalisation — Frais fixes	Matériel électrique — Canalisation — Frais variables	Exploitation — Frais fixes — Amortissement	Exploitation — Frais variables — Charbon — Frais fixes	Exploitation — Frais variables — Charbon — Frais variables	Exploitation — Frais variables — Graisse — Frais fixes	Exploitation — Frais variables — Graisse — Frais variables	Matériel moteur
		fr.	fr.	fr.	fr.	fr.	fr.	fr.	fr.	fr.	
1 dynamo E	19 lampes A	1050		1252	"	2,38	1,23				
	19 " B	2060	"	2118	"	1,85	1,34	"	"	"	
	60 " A	5260	"	5110	"	1,86	2,24	"	"	"	
1 dyn. Z	80 " A	5550	"	5750	"	1,6	"	"	"	"	
	80 " B										
	120 " B	6550	"	6570	"	1,65	2,24	"	"	"	
1 dyn. L	150 " A	8525	2500	9900	12500	3,78	2,40	2,32	0,25	0,72	16,50
	75 " A	4553	2100	11100	1600	"	"	"	"	"	
	100 " B										
	500 " B	11350	15500	12500	18500	1,34	1,77	1,23	1,50	2,25	
1 dyn. K	250 " A	15825	"	14450	"	1,66	2,17	"	0,65	"	29,500
	100 " A	15850	"	15650	"	"	"	"	"	"	
	200 " B										
	500 " B	17200	"	15450	"	1,29	1,65	"	2,90	"	
2 dyn. Ji	300 " A	19050	"	18600	"	1,64	2,27	"	0,81	"	33,700
	150 " A	20975	"	22200	"	"	"	"	"	"	
	300 " B										
	600 " B	23100	"	24600	"	1,28	1,72	"	2,81	"	
2 dyn. K	500 " A	27650	"	28900	"	1,50	1,92	"	3,02	"	42,500
	200 " A	31190	"	33700	"	"	"	"	"	"	
	600 " B										
	1000 " B	34000	"	36900	"	1,22	1,60	"	3,37	"	

	Electromagnet													Armature									
	Core				Fils				Noyau			Poids		Longueur et largeur	Epaisseur	Fils	Nombre de couches	Diamètre du fil	Résistance	Poids	Nombre de tours	
	Diamètre	Longueur	Poids	Diamètre	Poids	Diamètre	Tours	Couches	Diamètre	Longueur	Hauteur	Fer	Cuivre	Diamètre									
25	145	300	38.6	8.9	3/10	230	22	30	200	140	28000	60		216 x 115	128	3/10	2	9 fois	32	0.4	4	1600	
50	160	350	55.	8.9	3/10	300	19	30	220	200	44000	165		234 x 122	180	3/10	4	4 "	54	0.18	8	1500	
200	230	520	170	47	16/10	275	14/15	43	280	280	78400	225		304 x 246	262	16/10	8	1 "	74	0.044	33	1200	
500	230	520	170	47	16/10	275	15	15	280	280	246400	700		304 x 246	279	16/10	21	1 "	44	0.016	75	750	



Charge dynamo in this manner and then connect brush pointed down to right hand kind pos

Brush pointed down will be + and the one by which the current issues from the armature.



Two machines running opposite

$\frac{E}{R} = C.$ $R \times C = E$ $\frac{E}{C} = R.$

Heat $= C^2 \times R$ or $\frac{E^2}{R}$

Energy. Kilgmt $C^2 \times R \div 9.81$ or $\frac{E^2}{R} \div 9.81$

or $E \times C \div 9.81$

Calculation of Wires.

$\frac{R \text{ of Wire}}{} = \frac{\text{length} \times \text{specific R.}}{\text{Section}}$

2 Wire system

Section $= \frac{2 \text{ distances} \times .017}{\frac{100}{\%}} \times \frac{1}{7} = 10\%$ loss.

$C = \frac{2d \times .017}{\frac{\%}{100} \times \frac{E}{R}}$ 10 amp.

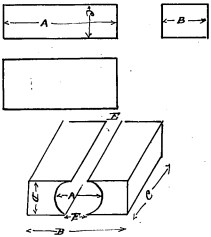
Length of wire $= \frac{R \times S}{\text{Spec R}}$.

Coût du kilowatt-heure en 1893.

Lampes.		Fr.	Kilowatts.
Lampes Hiaks	No 2	12	32
" " "	4	16	43
" " "	6	25	117
Edison	A	16	43
"	B	8	40
Lampes Jablochkoff		20	96
Lucem		15	66

Machines Edison.
Prix du matériel moteur pour les dif. types
Cas d'un moteur à gaz.

Matériel moteur.	Installations								
	17 lampes A 16 4 chevaux	25 lampes A 16	50 lampes A 16 8 chevaux	60 lampes A 16	100 lampes A 16 16 chevaux	120 lampes A 16	150 lampes A 16 20 ch.	200 lampes A 16 25 ch.	250 lampes A 16 40 chevaux	300 lampes A 16
Moteur	4000		7000		12500		14000	15000	19000	
Fondations	70		90		100		120	150	200	
Tuyauterie	300		350		400		450	500	750	
Transmission & fonds	500		680		800		1200	1500	2000	
Courroies	150		250		350		500	650	800	
Montage	100		150		150		200	300	400	
Totaux :	5120 f.		8520 f.		14300 f.		16470	18100	23150	
Prix par lampe.	301,176	204,80	170,40	142,-	143,-	119,166	109,80	90,20	92,60	77,166



Dynamos.

Type	17	60	120	150	300	250	500	25	200	50		
	Keeper											
A	375	614	645	660	645	610	700	460	530	520		
B	148	200	281	202	230	202	290	200	280	220		
C	122	160	160	170	205	165	145	85	145	92		
	Magnet head.											
A	132	265	265	270	270	275	546	180	269	180		
B	420	630	640	630	640	630	1346	460	670	520		
C	190	242	268	493	565	750		200	280	220		
D	130	276	276	276	276	276	556	140	280	190		
E	63	75	75	110	110	150	140	60	120	80		
F	63	75	75	80	90	90	120	50	75	58		

Arma Ture -

	t	√	√	√	√	√	∠						
Type.	2000 ℔	60	120	150	300	250	500	25	200	50	1000 ℔	500	
Diam. ext. of wire	126	260	260	262	262	265	265	125	260	150		270	
" of core.	113	246	246	246	246	246	246	113	246	152		246	
" of Wood.	50	125	125	125	125	125	125						
" of Shaft.	26½	48	48	76	76	89	89						
Pulley. { Diameter	130	254	254	350	350	350							
Pulley. { Largeur	80	162	162	220	231	230							
Number. Wires	2	6	12	6	12	10	21	2	8	4	2	21	
" turns round	8	2	1	2	1	1	1	9	1	4	12	1	
" of Sections	24	44	44	54	54	64	44	32	44	54	24	44	
Resistance	·35	·142	·042	·07	·0172	·035	·01	·42	·029	·126			
Weight of wire Kg.		12	15	22·3	29	32·6	73	6·8	20·2	10·8			
Diameter Wire	12/10	12/10	12/10	16/	16/	16/		12/10	16/10	12/10	19/	16/12	
Largeur de rapport	194	277	277					216	304	216		904	
Revolutions	2200	1200	1300	850					1200				

Magnet Cores

	14	60	120	150	300	250
Diameter	115	160	205	160	205	160
Longeur	431	1070	320	1070	320	1070
Thickness wood each end	10	10	10	10	12	10
Diameter cast of wire		192		192	250	192
Cores to machine	2	2	2	4	4	6
Weight of each core						
Diam of wire dimension	9/	14/	16/	14/	16/	16/
" " " covered		18/	21/	18/	21/	18/
number of layers	12½	6½	11½	8½	14	6½
" " turns per layer	122	545	290	545	290	545
Hot Resistance	90	42	45	22½	22½	14
Poids de Noyau Cre	8·9	35·5	47	30·5	47	30·5

500	25	250	50	17	500	
235	145	230	160		230	
145	300	520	350		520	
12	13					
216	188	280 / 300	192 / 270			
6	2	2	2		6	
	Dito					
16/	9/	16/	9/		16/10	
21/		21/				
12	14	12	11 / 12		12	
234	220	234				
13	7½	45	7½		13	
47	8·9	47	8·9		47	

Winding of Armatures.

60 Lamps A

6 Wires of 12/10 twice round
Resis. ·125
12 Kid wire

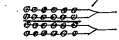
120 Lamps A

12 Wires 7/10 once round
R. ·042

150 Lamps A

6 wires of 12/10 twice round
R = ·07

300 Lamps A



12 Wires 16/10 once round
R. = 0.0175

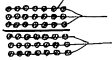
17 Lamps A 2200 turns

17 Lamps A 1700 turns

250 Lamps A

10 Wires 16/10 once round
R. ·035

500 Lamps A



21 Wires 16/10 once round
R. ·01

25 Lamps A

2 Wires 12/10 9 times round
R = ·42

50 Lamps A

4 Wires 12/10 4 times round
R = ·048

Armatures (continued)

200 Lamps A.

8 Wires 16/10 mil round

R = ·029

Gauge Birmingham

B.W.G.	Diameter Inch	Diameter Millimet	Section in millim. carrés	B.W.G.	Diameter Inch	Diameter Millimet	Section in millim. carrés
1	·300	7·62	45·60	21	·032	0·812	0·515
2	·280	7·11	39·70	22	·028	0·711	0·595
3	·260	6·60	34·21	23	·024	0·609	0·291
4	·240	6·09	29·12	24	·022	0·558	0·244
5	·220	5·58	24·45	25	·020	0·508	0·202
6	·200	5·08	20·26	26	·018	0·457	0·164
7	·180	4·57	16·40	27	·016	0·406	0·129
8	·164	4·16	13·59	28	·014	0·355	0·098
9	·148	3·76	11·10	29	·013	0·330	0·085
10	·132	3·35	8·81	30	·012	0·304	0·072
11	·120	3·04	7·23	31	·011	0·279	0·061
12	·108	2·74	5·89	32	·010	0·254	0·050
13	·096	2·43	4·65	33	·009	0·228	0·040
14	·084	2·13	3·56	34	·008	0·203	0·032
15	·072	1·82	2·60	35	·007	0·177	0·025
16	·064	1·62	2·06	36	·006	0·152	0·018
17	·056	1·42	1·58	37	·005	0·127	0·012
18	·048	1·22	1·16	38	·004	0·101	0·008
19	·040	1·01	0·80	39	·003	0·076	0·004
20	·036	0·91	0·65	40	·002	0·050	0·002

Charles Batchelor Notebook, Cat. 1306

This notebook covers the period September 1883-July 1884. Most of the entries are by Charles Batchelor. The book contains notes, drawings, calculations, and graphs relating to lamps and dynamos. There are approximately 120 unnumbered pages.

1. Friction Metal.

Metal for heavy weights & high speed.

Tin	35
Zinc	50
Lead	10
Antimony	5
	100

Antifriction metal

Copper	5
Zinc	85
Antimony	10
	100

---

2. Sept 4 1883

Section wire in armature –

In armatures made with wires you must have a section of wire 0·18 mm for each lamp of ·75 ampere then

Lamps	Section	Amperes
1	·18	·75
6	1·	4·5
1·25	·225	1

3. Unit of Magnetic field Jan 1884

that strength of field that will give 1 volt in 1 metre of wire cutting it at 1 metre in 1 second

M = unit of magnetism

L = total length of wire that cuts the field of force and it is found by. length of field × 2 × number of blocks ÷ 2 if multiple used

V = Velocity of cutting speed turns Rev × Diameter ÷ 60 for second.

then $E = M \times L \times V$

and $M = \frac{E}{L \times V}$

Now as 200 light gives 110 volts at 1200 turns we can get the magnetism from the following:-

$$\cancel{M = \frac{110}{280 \times 2 \times 14} \times \frac{1200 \times \cdot 246}{60}}$$

$$M = \frac{E}{L \times V} = 110 \div \left(\frac{\cdot 280 \times 2 \times 14}{2}\right) \times \left(\frac{1200 \times \cdot 246}{60}\right) = \frac{110}{101 \cdot 5} \text{ or about } 1 \cdot 08$$

Now the magnetism of the old 60 light L would be as follows:-

$M = \frac{E}{L \times V} = 110$ ohms

$$\frac{\cdot 24 \times 4 \times 44}{2} \times \frac{1200 \times \cdot 251}{60} =$$

$$\frac{110}{178 \cdot 31} = \text{about } \cdot 62\%.$$

In the 200 light the percentage of Section of Core to section of head is 56% and the current passed round the magnet is

$$\frac{110}{45} \times 14 = 34 \cdot 16 \text{ amperes.}$$

In the old L the percentage is

$$\frac{213820}{60240} = 35\tfrac{1}{2}\%$$

and the current passed round the magnet was

$$\frac{110}{42} \times 4 = 18 \cdot 34 \text{ amperes.}$$

New 100 light machine

Quest. 1 Have we enough section for lamp?

Yes. C = 75 amperes. we have 6 wires 2 times round of 14/10 =

1·53 × 6 = 9·18 + 9·18 = 18·36

75 Amperes ÷ 18·36 = 4 amperes about

Dia = 1·08 then

$E = M \times L \times V =$

$= 1{\cdot}08 \times \frac{250 \times 2 \times 64 \times 1350 \times 748}{2 \quad 60} =$

1·08 × 16 × 3·35 = Volts 8·4·54

I forgot that the wire is twice round + then divided by 2

= Volts 15·08

4 New 100 light Dynamo.

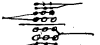
Feb. 20 1884

Armature :-

64 Blocks.

6 Wires of 14/10 twice round

Iron core 250 × 148



Magnet :. 250 × 150 cast Corners of 50 mm radius –

Section 35354

Section of armature iron cut away 37848. therefore percentage is $\frac{35354}{37848} = 91\%$

Current round magnet is 27 amperes or 4·84 × 16 layers.

Length of magnet.

60 ohms of 12/10 = 70·24 metre

× 60 = 4214 metre.

or 210·7 metre for each coil

$\frac{210{\cdot}7}{15} = 14{\cdot}0$ metre each layer

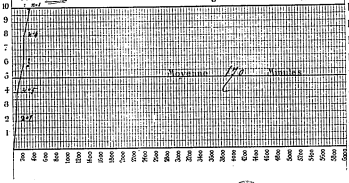
Perimeter of core with 1/2 layers on = ·789

$\frac{110 \text{ metre}}{\cdot 789} = 144$ turns.

·0112 + ·0004 × 144 = ·283 length of core.

Copper on magnets 42 Miles or ·420 per amp.

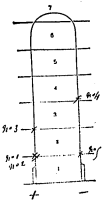
N° 1 Essai à 10. Bougies



Lampes	4 à 10. bougies	
Fabrication	23 Janvier 1884	
Dimensions	5 x —	
Intensité normale	10 bougies	
	2 10 bougies	2 10 bougies
Rés à chaud	1,73.9	1,79.9
Volts	94.6	115.2
Courant en Amp.	2,995	2,701
Kilogrammètres	5.6	10.2
Lamp Chev. vapeur	51.2	7.3
Durée moyenne		

4460 - 49 m

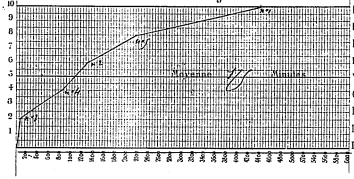
1/9



1° — 31f Meinetter.
2° — 50
3 — 20f
4 — 26g
5 — 7L

469. 24 juin

N° ..... Essai à 64 Bougies



Lampes	A16 Hans de Ricky	
Fabrication	13 Février 76	
Dimensions	6 x 0.03 x 0.14	
Intensité normale	16 Bougies	
Rés. à chaud	723-8	114.5
Volts	98	111.1
Courant en Amp.	0.791	1.019
Kilogrammètres	75	11.95
Lamp Chev. vapeur	9.85	5.68
Durée moyenne		

N° 3. Fils de platine soudés
au fils —
Verre brisé

N°	Abo Minutes
2	126
3	15
4	82
5	217

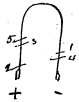
7. Lamps. 22 Feb 1884

3" × ·007 × ·0135" –

8 Bougies & 32 bougies

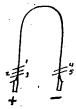
Hydrogen 258 cubic = 684 heures.

	8 bougies	32 bougies
Res.	67.03	61.59
Volts	51.3	63.
Amp.	·766	1.023
Relgn	3.93	6.51
Lamps par Ct.	19.5.	11.5



1 — 456 minutes
2 — 18
3 — 231
4 — 464
5 — 122
5/1291
258 minutes

8 Lamps B16. (No 35)



Made. 19 May 83	1	— 303
" Jan 1884	2	— 136
March 83.	3	— 284
May 83	4	337
Feb. 1884.	5	75
		5/1139
		228 minutes

At 64 candles

	Rest. Volts.	Amp.	Wtg	H.P.
16 CP	32.32.	46.58	1.47	7	10.5
64 CP	34.08	57.1	1.95	11.7	6.3.

228 × 2.65 = 604 hours.

~~Feb.~~ March 4 1884

9 We must make a lamp of 68 Volts and 16 candle power

·008 × ·0135" Carbon = ·000108"

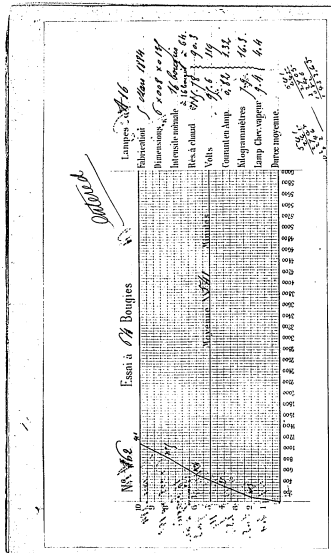
Resistance per Centimetre 24·20 ohms.

·008" = 0·2032 m m
·0135 = 0·343 " "

·2032 × ·3429 = ·0697 m m section

1" ÷ ·0697 = 14·352.

$\frac{24.20}{14.352}$ = 1·609 ohm Resist per m m per centimetre long.



8 X 13 fibre takes 1 volts for every ·0015 m

6 P volts = ·80 amp = 85 ohms.

fibre 8 X 14 section = ·2032 X ·4318 = ·0877 m.m

Surface of $\frac{P}{13}$ = 1·0922 m.m X 152·4 m = 156·45 m.m.

156·45 ÷ 16 = 9·77 m.m per candle.

∴ Surface same

Candle power same

Energy same

Smallest practical width 0·127 m.m

103 X ·75 = 77·25

∴ 6P X 1·13 = 77·25

Length — 34% = length ~~[illegible]~~ 152 = ·110 m.m

Section + 34% = section = ~~·0877 + ·0293 m.m~~ ·06088 + ·0236 = ·09327 m.m c

·25 × ·47

~~·2032 X~~

156·45 ÷ 110 long = 1·42 m.m round edge

We want 2 number that X together must make ·09327 m.m

·53 × ·18 110 m.m

No 1 — 1048 minutes
2 — 251 "
3 — 68 "
4 — 497 "
5 — 808 "

5 | 2706
541
265

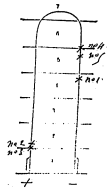
8 X 13½ fibre takes 1 volts for every ·0015 m
6 P volts ÷ ·80 ampere = 85 ohms.
fibre 8 X 14 section = ·2032 X ·4318 = ·0877 m.m
Surface of 1/13 = 1·0922 m.m X 152·4 m. = 156·45 m.m
156·45 ÷ 16 = 9·77 m.m per candle.

∴ Surface same
Candlepower same
Energy same
Smallest practical width 0·127 m.m
103 X ·75 = 77·25
∴ 68 X 1·13 = 77·25
length — 34 m = length 152 m. — ·110 m.m
section + 3 m = section = ·06708 + ·0236 = ·09327 m.m
·09327 m.m c

·25
·47

~~·2032 X~~
156·45 ÷ 110 long = 1·42 m.m round edge
We want 2 number that X together must make ·09327 m.m

·16 110·0 m.m
·53



No 1 — 1048 Minutes
2 — 251 "
3 — 68 "
4 — 497 "
5 — 808 "

5 / 2406
5 41
2 6 5
2 4 0 5
3 2 4 6
1 0 8 2
1 4 3 3 6 5

8 X 1½ fibre takes 1 volt for every ·0015 m
6 P Leclanché = ·80 ampere = 85 Ohms.
fibre 8 X 1½ section = ·2032 X ·4318 = ·0877 4176 m m

Surface of $\frac{8}{13}$ = 1·0922 m m X 152·4 m = 156·45 □ m m
156·45 ÷ 16 = 9·77 □ m m per candle.

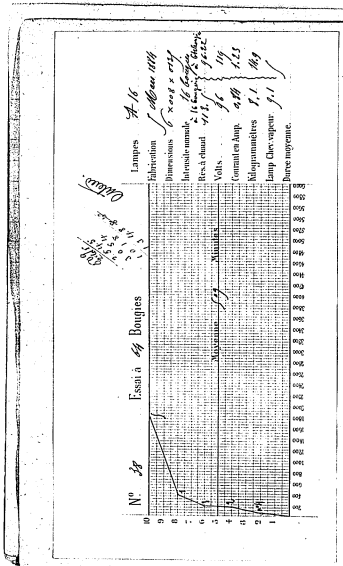
∴ Surface same
Candle-power same
Energy same
Smallest practical width 0·127 m m
103 X ·75 = 77·25
∴ 68 X 1·13 = 77·25
length — 34% = length ~~[illegible]~~ 152 = ·110 m m
~~·06066 + ·0236 = [illegible]~~
Section + 34% = section = ~~·0877 + [illegible]~~ ·09327 □ c

·25
·47

~~·2032 X~~

156·45 ÷ 110 long = 1·42 m m round edge
We want 2 numbers that X together equal make ·09327 □ c

·15
·53
110 m m



Tests Calculation

Length.	101.45 m m
Width.	.66285 m m
Thickness.	.15495 m m
Resist.	54.45 ohms.

$\frac{l}{a\,b} \times S_k = 125$:

$S/K = 56.18$ 68 Volts 16 candles

Surface 166.45

Length	100 m
Width	0.673
Thickness	0.15495
Resist	54.45 ohms

Jacks Calculator

Length.	101.45 m m
Width.	·66285 m m
Thickness.	·15795 m m
Resist.	54.75 ohms.

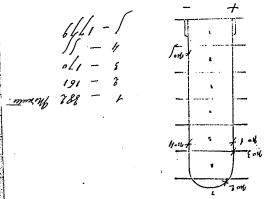
$\frac{l}{a\,b} \times \frac{1}{R} = 125$

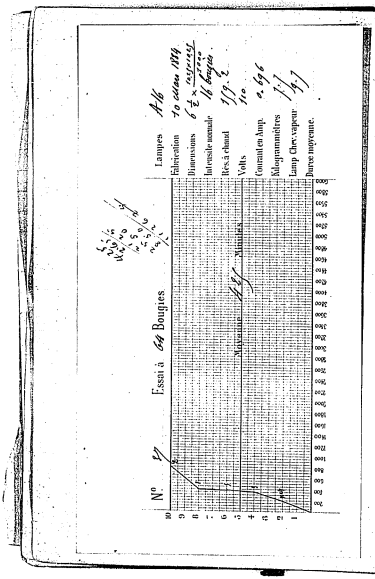
$1/R = 9648$

68 Volts 16 candles

Surface 166·45

Faraday	100 m
Width	0·673
Thickness	0·15795
Resist	54·75 ohms





Specific Resist = 0·0697 = 152 ohms.

·0697 X 14·347 = 1 ㎠ carb

∴ 152·4 : 125 ohm :: 1·000 : 820 ohms

820 ÷ 14·347 = 55·86 Specific Resistance of our Carbon

---

103 X ·75 = Voltamperes = 77·25

68 X x = 77·25 = 68 X 1·133 = 77·25 Voltamperes

∴ Current = 1·133 amperes

$\frac{E}{C} = R = \frac{68}{1.133} = 60$ ohms.

152·4 X (·2132 + ·2032 + ·343 + ·343) = Surface 166·48 m m

·2032 X ·343 X 152·4 = 10·622 Solid content

$\text{Section} = \frac{\sqrt{10.622 \times 55.86}}{60} =$

Specific Resist = 0·0697 = 152 ohms.

·0697 × 14·347 = 1 carré

∴ 152·4 : 125 ohms :: 1·000 : 820 ohms

820 ÷ 14·347 = <u>55·86</u> <u>Specific Resis-</u>
<u>tance</u> of our Carbon

---

103 × ·75 = Voltamperes = 77·25

68 × x = 77·25 = 68 × 1·133 = 77·25
Voltamperes

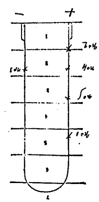
∴ Current = 1·133 amperes

$\frac{E}{C} = R = \frac{68}{1{\cdot}133} = 60$ ohms.

152·4 × (·2032 + ·2032 + ·343 + ·343) =
Surface 166·48 m m

·2032 × ·343 × 152·4 = 10·622
Solid content

$\text{Section} = \frac{\sqrt{10.622} \times 55{\cdot}86}{60} =$



No 1 — 400 Minutes
2 — 805 "
3 — 347 "
4 — 197 "
5 — 377 "

Current	per % Section	Core Sec.		
15.25	48 %	10387		
26.84	67 %	16513	1500 Rev	
23.18	56 %	20106	1500 Rev	
18.34	35½ %			
28.06	46½	33006		
32.5	28	40212		
34.16	56 %			
49.27	33	60318		
68.32	47½	66012		
109.95	56 %	124644		

Mch. 12 1884

Magnetism on Edison Dynamos.

Machine	Length of WIRE	per Sec Velocity	Section	Ampères	M
17	36.48	4.143			.728
17					
25	57.6	2.82			68
50	47.52	3.8			.61
60	35.816	4.92			.68
100					
120	21.317	5.33			.967
150	53.244	3.485			.59
200	20.72	4.92			1.08
250	46.72	3.69			.638
300	30.51	3.69			.977
500					

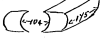
Berlin March 15 1884

Price Siemens Machines for incandescent lights (Compound) in Berlin

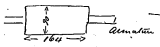
Type	Lamps (C)	Weight	Price
g D 16	12.	130 K	M 800
g D 17	25	210	1100 mk
g D 18	40	300	1600 mk
g E 8	75	—	—
g E 14	100	650	2500
g E 15	150	800	3600
g E 20	200	1270	4300

X Edison T machine 100 A lamps.

4 Cores. 258 long
126 Diameter
Ratio of section Head 80%



Each core 14 layers No 20 A.W.G.



Resistance 1 — 63·34
Siemens unit 2 = 61·59
3 — 63·70
4 = 64·20

190 X 140
Pulley

Armature Resistance
·0160 1
Siemens unit

Resultant magnets + armature of
H Machine from Newyork
6 cores 1 - 14.80
2 - 14.50
3 - 16.36
4 - 14.20
5 - 13.71
6 - 14.00
Armature .00224? 3 strands .02243.

---

50 light machine american make
Magnet
54.4 Armature
48.7 .131

---

25 light machine
31.6
34.0 Armature .3526

Calculation for incandescent lamp.

Take the ~~[illegible]~~ formation of a lamp of n candles at e volts when you have the measure of one of n candles and E volts then $e\,i\,n$ $s = a\,b\,l$ lamp given

" $E\,I\,R$ $S = A\,B\,L$ lamp to find

The luminous intensity must be the same the density of the current must be the same as $\frac{S}{I} = \frac{s}{i}$ or $\frac{A\,B}{I} = \frac{a\,b}{i}$

The quantity of light must also be the same because the surface is the same

$$(A+B)\,L = (a+b)\,l$$

If the economy must also be the same then $E\,I = e\,i$. $\frac{E^2}{R} = \frac{e^2}{r}$

$$\frac{E^2 AB}{L} = \frac{e^2 a\,b}{l}$$

Now admitting these we can proceed thus

$- \quad I = \frac{el}{R}$ $\qquad I = \left(\frac{e}{R}\right) i$

$- \quad R = \left[\frac{R}{I}\right] = \left[\frac{R}{el}\right] = \left[\frac{R}{e}\right] l$ $\qquad R = \left[\frac{R}{e}\right]^2 r$

$- \quad S = \left(\frac{I}{e}\right) s = \left[\frac{e}{E}\right] s$ $\qquad S = \left[\frac{e}{E}\right] s$

or $AB = \left[\frac{e}{E}\right] s$

$- \quad \frac{L}{SR} = \frac{l}{sr}$ $\quad L = \frac{e}{E} s \cdot \frac{E^2}{e^2} r \times \frac{l}{sr}$ $\qquad L = \left(\frac{E}{e}\right) l$

$- \quad (A+B) L = (a+b) l$ $\qquad A+B = \left(\frac{e}{E}\right)(a+b)$

Application :- To make a lamp of 16 candles & 68 Volts

Given $e = 105$ $\quad r = 125$ $\quad i = \frac{e}{r} = 0.84$

$a = \frac{13}{1000}$ $\quad b = \frac{9}{1000}$ or $a = 0.13$. $b = 0.205$. $l = 154$

$a \times l = .167$. $a + b = 0.335$

Result. $E = 68$ $\quad I\ 1.3$. $R = 52.42$

$S = .10797$. $L = 99.7$

$AB = .10797$ $\qquad A + B = .821$

$A = .656$ $\quad B = .165$

Quantity of light – for the same intensity – the quantity of light is proportional to the number of candles

$(A+B) L = \frac{N}{a}(a+b)$ –

$$\begin{array}{r} \cdot 2165 \\ \cdot 300 \\ \hline \cdot 07165 \\ 12\cdot 17 \\ \hline 36\,1\,5\,5 \\ 5\,1\,6\,5 \\ \hline 5\,1\,6\,5 \\ \hline 5\cdot 2\,5\,2\,8\,0\,5 \end{array} \qquad \begin{array}{r} \cdot 203 \\ \cdot 343 \\ \hline \cdot 5\,4\,6 \\ 1\cdot 12 \\ \hline 2\,7\,3\,0 \\ 5\,4\,6 \\ \hline 5\,7\cdot 3\,5\,0 \end{array}$$

General equation:

$$I = \frac{N}{n}\,\frac{e}{E}\,v \qquad I = \left(\frac{E}{e}\right) l$$

$$R = \frac{n}{N}\left(\frac{E}{e}\right)^2 r \qquad A + B = \frac{N}{n}\,\frac{e}{E}\,(a + b.)$$

$$AB = \frac{N}{n}\,\frac{e}{E}\,ab.$$

Wanted a lamp of 6 Volts and 10 Candles

Same cenny a. Ou 6 x 00F x 0125 —

Given $e = 103$ $r = 125$ $a = \cdot 203$ $b. = 0\cdot 343$

$l = 154$ $E = 68$ $N = 10$ $i = \cdot 224$

$$I = \frac{N}{n} \times \frac{e}{E} \times i = \frac{10}{16} \times \frac{103}{68} \times \cdot 224 = \cdot 965 \times \cdot 224 = \cdot 2165$$

$$R = \frac{n}{N}\left(\frac{E}{e}\right)^2 r = \frac{16}{10} \times \frac{68^2}{103^2} \times 125 = 16\cdot 25$$

$$I = \left(\frac{E}{e}\right) \times l = \frac{68}{103} \times 154 = 101\cdot 7 \text{ Ohm}$$

$$AB = \frac{N}{n} \times \frac{e}{E} \times ab. = \frac{10}{16} \times \frac{103}{68} \times \overset{\cdot 06965}{(\cdot 203 \times \cdot 343)} = 0\cdot 06968$$

$$A + B = \frac{N}{n}\,\frac{e}{E}\,(a + b) = \frac{10}{16} \times \frac{103}{68} \times (\cdot 203 + \cdot 343) = \cdot 5165$$

$A = \cdot 2165$ $B = \cdot 300$

It's evident that for the same luminous intensity the quantity of light is proportional to the radiating surface

I = length	l = length
Standard type $S = AB$ = section	$a - ab$ = section
I.E.R. = Elect. constants.	i.e.r. constants
N = candles	n candles
$D = \frac{I}{AB}$ = density of current	$d = \frac{i}{ab}$ = density of lamp to get

$$\frac{ci}{R} = \frac{EI}{N} \qquad \frac{(a+b)d}{n} = \frac{(A+B)D}{N}$$

$$\therefore \frac{ci}{EI} = \frac{n}{N} \quad \text{also} \quad \frac{(a+b)d}{(A+B)D} = \frac{n}{N}$$

As e & n are generally given we can say that

$$i = \left(\frac{n}{N}\,\frac{E}{e}\right) I \qquad r = \left(\frac{N}{n}\,\frac{e^2}{E^2}\right) R$$

$$l = \left(\frac{n}{N}\right) \times I$$

$$a + b = \frac{n}{N}\,\frac{l}{I}\,(A+B)$$

$$ab = \frac{n}{N}\,\frac{l}{I}\,\frac{E^2}{e^2}\,AB$$

$$\frac{l}{ab}\,\rho = \left(\frac{n}{N}\,\frac{e^2}{E^2}\right)\frac{I}{AB}\,\rho$$ ρ being a coefficient which takes into consideration new hot & shrinkage.

during carbonization we shall have

$$\frac{ab}{AB}\,\frac{l}{I}\,\frac{E^2}{e^2} = \frac{n}{N} \qquad \frac{a+b}{A+B}\,\frac{e}{I} = \frac{n}{N}$$

Law of incandescence – X

It seem to result from maps made till now that for the same luminous intensity the amount quantity of energy for candle is constant (if we keep the same surface for candle as we have in the 8 X 13½ filament we are sure of an life and if we give the same surface per candle for all lamps we are sure of life) Now on electromotive force being always constant the ampere will be proportional to the number of lamps

Then. $EI = N(ei)$ $\quad ei = n(ei)$

$$\frac{EI}{N} = \frac{ei}{n} \qquad E = e.$$

$$\frac{I}{N} = \frac{i}{n} \qquad \frac{I}{i} = \frac{N}{n} = \frac{A+B}{a+b}$$

$$\frac{R \times I^2}{r\,i^2} = \frac{N}{n} \quad \text{i.e.} \quad \frac{R}{r} = \frac{N}{n}$$

$$\frac{I}{i}\,\frac{ab}{AB} = \frac{n}{N}$$

i.e. $\frac{A+B}{a+b} = \frac{N}{n} = \frac{I}{i} = \frac{a}{A} = \frac{AB}{ab}\,\frac{i}{I}$

Then it results that the greater the section the larger it must be – for intensity of current being same the density of the current will be smaller

Then for a lamp of 50 candles the dimensions would be as follows:—

Given:- $e = 103$ $R = 125$ $i = \cdot 824$ $n = 16$

$a = \cdot 203$ $b = \cdot 343$ $l = 1514$ $ab \cdot 07 = \cdot 06969$

Given also:- $E \cdot 103$. $N = 50$

Then

$$R = \frac{n}{N} \cdot \frac{E^2}{e^2} a = \frac{16}{50} \times \frac{103^2}{103^2} \times 125 = \cdot 32 \times 125 = 40$$

$$I = \frac{N}{n} \times \frac{e}{E} \times i = \frac{50}{16} \times \cdot 824 = 2 \cdot 57 \quad 2 \cdot 6 \text{ ft. amp.}$$

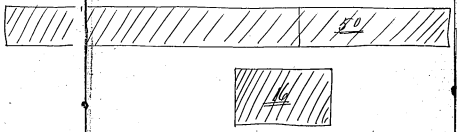
$$I_1 = \frac{E}{e} \times l = 1514 \text{ ---}$$

$$AB = \frac{N}{n} \times \frac{e}{E} \times ab = \frac{50}{16} \times (a \times b) = \cdot 21984$$

$$A + B = \frac{N}{n} \times \frac{e}{E} \times (a + b) = \frac{50}{16} \times (a + b) = \cdot 771$$

$$A = \cdot 140$$

$$B = 1 \cdot 570$$



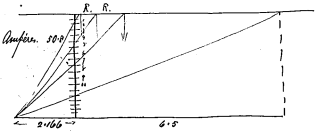
For 6 lbs

1 R = 13 = ohm

then 13 ÷ 6 = 2·166 total machine

2·166 × 3 = 6·498 or 6·5

then



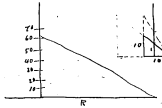
5

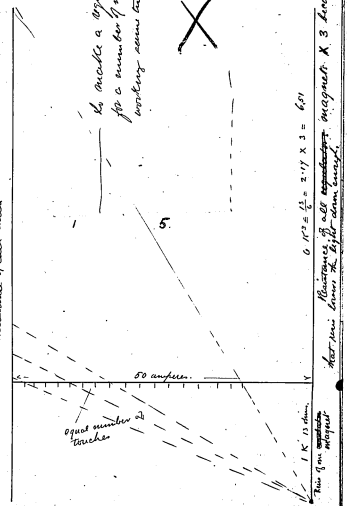
$$\begin{array}{r} 6.5 \\ 2.166 \\ \hline 3.666 \end{array}$$

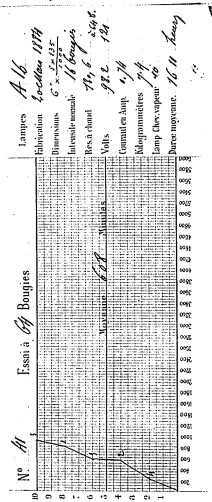
$$\begin{array}{r|l} 110 & \\ 2.166 & 50.8 \\ \hline 1.1 & \\ 1.1 & \\ \hline 1.0 & \\ 1.0 & \\ \hline 1.0 & \\ 1.0 & \\ \hline 1.0 & \end{array}$$

$$\begin{array}{r|l} 110 & \\ 3.666 & 30 \\ \hline 110.000 & \\ 36.66 & \\ \hline 73.340 & \end{array}$$

Volts







Febres:- 6" × .008" × .0135"

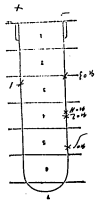
Average of	20.	159.6	×	287.1
"	40	159.6	×	286.3
"	60	160.	×	283.1
"	80	159	×	282.4
"	100	158.9	×	281.8
"	120	158.8	×	282.9
		956.2	×	1703.6

Average. 6" × .007968" × .014197"

6½ × .008" × .0135"

20	—	162	×	240.
40	—	160.5	×	263.2
		160.6		242.1
		161		241.4
		161.1		241.6
		162.		240.6
		964.2		1618.9

155 – 5
172 – 4
176 – 5
191 – 3
191 – 108 Fluorescence



Fibres:- 6" × ·005" × ·0130" X

Average of	20.	159·6	×	284·1
"	40	159·6	×	286·3
"	60	160·	×	283·1
"	80	159	×	282·4
"	100	158·9	×	281·8
"	120	158·8	×	282·9
		956·2	×	1423·6

Average. 6" × ·004968" × ·014197"

6½ × ·005" × ·0135" — 20 — 162 × 270.

40 —	160·5	×	263·2
	160·6		272·1
	161		271·4
	161·1		271·6
	162·		270·6
	967·2		1615·9

Gouck St Newark May. 16 1844

Heat radiates from Armature of Edison Machines per inch of Surface

H Machine (new) at 400 amperes.

R on Armature (effective) =

·013 x 76% = ·0099 ohms

Current 400 amp

Surface inches = 1006

$400^2 \times ·0099 = 1584$ heat units

$1584 \div 1006 =$ 1·57 HU per inch

S Machine at 184 amperes.

R armat ·022 x 63% = ·0138 ohm

Surface 544 inches

$184^2 \times ·0138 = 467$ heat units

$467 \div 544 =$ ·86 HU per inch

H. Machine at 325 amperes.

R. effective ·0099

$325^2 \times ·0099 = 1045$ heat units

$1045 \div 1006 =$ 1.03 heat per inch

New York May 16 1944

S machine at 200 amperes

R = ·0138

Surface 544 inch

$200^2 \times ·0138 = 552$ heat U

$552 \div 544 =$ 1.01 HU per inch

T Machine at 92 amperes.

R effective = ·043 × 67% = ·0467 ohm

Surface 324 inches

$92^2 \times ·0467 = 395$ HU

$395 \div 324 =$ 1.22 HU per inch

T Machine at 115 amperes.

R = ·0467

S 324 inch

$115^2 \times ·0467 = 617$ HU

$617 \div 324 =$ 1.90 HU per inch

C machine at 24 amperes

R = ·312 × 67% = ·209 ohm

Surface 177 inch

$24^2 \times ·209 = 120$ HU

$120 \div 177 =$ ·68 HU per inch

see page.

Lamps a Incandescence.

As we have decided that the surface per candle in the lamp of 16 candles cannot be decreased what is the best form of section that will use the least current?

(16 candle lamp section 0.203 X 0.343)

16 candle.	Section	Surface	
·203 x ·343	·069629	1.092	
·273 X ·273	·074529	1.092	

Density of current in each case:

$\cdot 203 \times \cdot 343 = \frac{1000000}{\cdot 069629} = 14.50 \times \cdot 75 =$ or 10.875

$\cdot 273 \times \cdot 273 = \frac{1000000}{\cdot 074529} = 13.42 \times \cdot 75 = 10.065$

Thus for 16 candle as we make it now the density of current is 10.875 ampere per millimeter square whilst with same surface with a square section we ~~so~~ have only 10.065 per mm carré.

50 light Machine of 500 Volts

Ordinary 50 light

$E = 110$ D ·152 N 4

M = ·61 C ·54 Resis ·486 ohm

L = ·220 R 1500 (Wire 12/10 [illegible])

outside diameter ·180

113 × 4 × 2 = 9·04 in sqrs.

40 amp ÷ 9·04 = 4·4 per sqrs in

Suppose 1 wire 16 times round.

then $E = M \times L \times V =$

$$·61 \times \frac{220 \times 4 \times 16 \times 54}{12} \times \frac{\overset{25}{1500} \times ·152}{\underset{1}{60}} =$$

$$·61 \times 190·08 \times 3·8 = 440·61 \text{ Volts}$$

Carrying 8 amperes 8 times be only 3 amp per 16 in circle

But volts not sufficient Resist 3 ohms

If I take 12/10 I can get 5 wires in same space as 40 of 12/10 in: (10 + 3 × 5 = 65) 12 × 3 × 4 = 6.0

the room I have is 152 × 3·14 = ·4774

·4774 − 2 × 54 for pins = ·369 ÷ 54 = 6·8 in

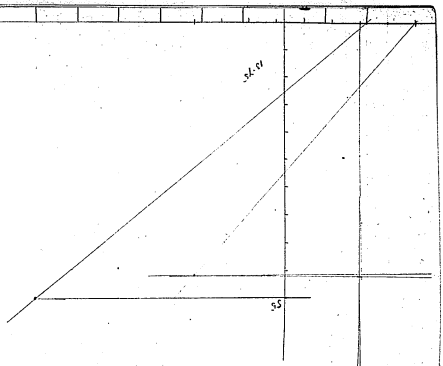
then N = 20

$$E = ·61 \times \frac{220 \times 20 \times 54}{12} \times 3·8 = ·61 \times 2376 \times 3·8 =$$

550 Volts

Resist. 5·25

2 Amperes 12/10 wire


55

R. machine at 46 amperes.

effective R = ·138 × 67% = ·0924 ohms

Surface 177 inches

$46^2 \times ·0924 =$ 195 HU

195 ÷ 177 = 1·1 HU per inch

Y Machine at 296 amperes

effect. R = ·0104 × 65% = ·00676

Surface 584

$\frac{296^2 \times ·00676}{584} =$ 1. HU per inch

Amperes & current per mm in the copper on Magnets

T $\frac{110}{1·159} \div 2·48 = \frac{77·21}{2·48}$ 31 mm

G $\frac{110}{61·75} \div ·62 = \frac{1·79}{·62} = 2·88$ " mm

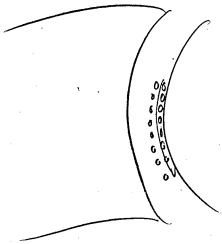
R $\frac{110}{23·9} \div 1·24 = \frac{4·6}{1·24} = 3·6$ per mm

S $\frac{110}{14·5} \div 3·4 = \frac{7·6}{3·4} = 2·24$ " "

Y $\frac{110}{1·53} \div 9·146 = \frac{9·92}{4·973} = 1·95$ " "

H $\frac{110}{8·55} \div 6·42 = \frac{13·53}{6·42} = 2·07$ " "

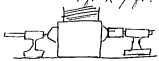
$\frac{E}{R} \div$ Section $= \frac{I}{S}$.



Newark. May. 17 1884

Machine of 250 amperes at 110 volts and 300 Revolutions

Space must not exceed 4 ft x 4 ft. + 6 ft high



to be left with shaft sticking out to connect to a motor –

Take 300 light cores ~~Order Obtained~~. 18¾" Diam x 21" long.

48 Divisions

Wound with 8 No 11 – 2 times round

~~Section = 4·3 x 8 = 34·4 m m.~~

~~34·4 x 2 = 68 m m~~

4 Wires twice round No 11 =

Amperes per m m.

~~4·2 x 4 x 2 = 250~~ ~~5·4 x 2 = 250~~

$$\frac{250 \text{ amperes}}{4.2 \times 4 \times 2} = \frac{250}{34.4} = 4.3 \text{ amp per m m}$$

Diameter of Commutator Blocks.

3·05 + ·3 x 8 = 26·8 m m.

~~Say 28 Mm.~~

Say 2 mm for Fibre = 28·8 each

18 3/4 inch diameter = 475 mm diameter
1147 ~~[illegible]~~ ÷ 22·5 = 52 cm block.

Length of wire
20 mm cow = 508 mm
18 3/4 " = 475 mm
L = 508 × 2 × 475 × 2 =
1966 × 52 = 102·23 metres

Resist = ·24 ohms
or multiple are ·06 ohm.

C.M.F.
E = N × L × V =
1 × 508 × 2 × 52 × 5/60 × ·475 =

1 × 52·83 × 2·375 = 125·48 volts

Heat radiates per 1 inch
R = ·06 × 58% = ·0312 rd
250² × ·0312 = 1956
Surface 1153
1956 ÷ 1153 = 1·7 heat units per inch

Seyffert. May 17 1884

Heat units per inch on Y machine

296 amperes

Arm. (18 x 9¾) 547 Sq. inch

Res. = ·0104 x 65% = ·00676

296² x ·00676 = ~~[illegible]~~ 1.08 H units

Magnetism on T Machine see Edison.

$M = \frac{E}{L \times U} =$

$120 \div \left(\frac{540 \times 6 \times 2 \times 60}{6}\right) \times \frac{1350 \times 490}{60}$

$\frac{120}{648 \times 4.27} = .43$

Section Rater = 330 x 178. — 41%

58740 Heat.

~~23950~~ Core

If we make $\frac{230 \text{ sq}^{\text{n}}}{41548}$ 71%

If we take 40 turn then we put 2.75 Ampere

In 18 Wire 6 Volts

~~Length 2280~~

~~Each core~~

2.75 Amp. 12 = 33.00

Circum 756

9304 feet = 40 turn

9304 ÷ 3.28 = 2830

÷ 2 = 1415

1415 ÷ 756 = 1890 / 12 | 1890 / 156 convolu.

156 x 1.65 =

Core 11½ x 9"

Wound with 12 Papers of No 18 Wire

Suppose 215 in a core

$\frac{36305}{58740} = 61\%$

1415 meter in 12 papers

9 inch = 230 m m diam

= 72 circum.

about 200 Convolution

for 12 papers. 163 convolution

#14 Wire 38 ohms 126 lb.

$\frac{110}{38}$ = 2·9 amperes

2·9 amps = 12½ capers.

13 capers

200 Convolution = 206

May 18 1884

Machine built by Colden

T – 100 amperes.

Armature 5·8 per ⊞ m.m.

Magnets 30·85 Resi.

#14 – 8½ capers. 2·79 Convol.

Wire diam ·058" outside ·070

Cores { 21½ X 7½.
540 X 190

% section { Arm. 13 X 7½ = 330 X 180
Core 28352
Head 59400 47%

Current Magnet.

3·5 X 9 = 31·5 amperes.

With an 8" core

204 Core Socta 32685
Arm. 59400 55%

With an 8½ core

215 = $\frac{36305}{59400}$ = 61%

$\frac{40828}{59400}$

9" core would be 67%

9" Core = 35 ohm wire #14

228 + 10 = 238

238 Circum = 748 m m

35 ohms #14 = 3478 metres

each core 1739 metres

$\frac{1739}{.748}$ = 2322 convolutions

~~24~~ 12 layers would be 3.14 x 12 = 38 amp

2322 ÷ 12 = 194 conv. to layer.

= 194 x 1.8 = 349 m m long core

116 ft. long

Then core 9" core 14 3/4 long.

Wound with 12 layers of #14 wire

May 18 1894

T machine at 100 amperes

.894 x 10 x 2 = 17.88

100 ÷ 17.88 = 5.6 amperes per ▨ m m

Radiation

$C^2 \times R$ = $100^2 \times (.0173 \times 62\%)$ =

$100 \times .0467$ = 467 HU

288 inches =

1.6 HU per inch

at 75 amperes .91 HU per inch

Z machine 54 amperes.

Current per ▨ m m

277 x 246

277
5.54
4.95
1046 / 5540 (0.53
5230
3100

$54^2 \times (.014 \times 53\%)$ = $54^2 \times .074$ = 216 HU

Inches. 306.1

.7 HU per ▨ inch

T Machine to carry 100 amperes
we must reduce armature
to ·05 ohms
How to do this !!!
Same length of No 18 wire would
be :— ·05 ohms

We can cut the plate 1/16
then diam = 4.186 +
Circum. 22.564 —
Now: 300 turns of ·065 = 19.500
60 Insul. fibre 250

R. Machine must be made
67% section & 38 amperes

now what is M on the $M = \frac{E}{L \times V} =$

$$\frac{110}{\frac{250 \times 7 \times 22}{7} \times \frac{1600 \times \cdot 126}{60}} =$$

$$\frac{110}{39.27 \times 336} = \frac{110}{132} = \cdot 83\ M$$

Section is $\frac{12469}{32130} = 39\%$

Current is $\frac{110}{39.27} \cdot 4.45 \times$

$4.45 \div 2 = 2 \cdot 225 \times 8\frac{1}{10} = 18.35$

Lake 183 m. in = $\frac{26302}{32130} = 85$ about
Lake 165 x in $\frac{21282}{32130}$ 66% good
We will put 55 ohms on & that will
be R 320 = 149.4 X 55 =
8217 feet X ·306 = 2506 metres
or 1253 metres each core
$\frac{110}{55} = 2 \times 19.36$
1253 metres ÷ ·593 = 2100 Convol.
189 X 3.14 = 593 circum
2100 Convol. ÷ 19 = 110 Cov per layer.
1·24 X 110 = 136 Cont of Cove

Suppose we add 50 ohms of #19 = 115.5

170.88 × 50 = 8544.00 feet or

8544
3.1416
25632
8544
26832.6144 meter

1288 meter each coil.

$\theta = \frac{144}{50} = 2.2 \times 17$ layers = 38 amperes

$146 \times 3.14 = 584$

$1288 \div 584 = 2200$ convol.

$2200 \div 17 = 130$ to core

$130 \times 1.24 =$

1.24
130
372
124
161.20

H machine ⟹ 5 ⟹ Look that ⟹

$M = \frac{E}{L \times V} = \frac{112}{32.82 \times \frac{1200 \times 1.242}{60}}$

$\frac{112}{32.82 \times 1.62} = \frac{112}{119} \quad 119 \overline{)112.0} \; 0.94$

476

32.82
1.62
6566
1966
3282
119.1364

.94 M

H machine May 20th 1894

24 Wires once comm

1200 Rev. 112 V 400 amperes

What is M

$M = \frac{E}{L \times V} =$

$L = 146 \times 2 \times 1 \times 44 = 32.82$

$V = \frac{1200 \times 1.242}{60} = 4.984$

$\frac{112}{32.82 \times 4.984} = \frac{112}{159} = .70$

Section $= \frac{46652}{180532} = 41\%$

~~If we put on 4 200 light coils~~

Current $= \frac{112}{8.38} = 13.5 \div 3 = 4.5$

$4.5 \times 8 = 36$ amperes.

If we put on 2 200 coils each side

Wd Section $= \frac{23326 \times 2 = 46746}{180532} \quad 48\%$

Current $= \frac{112}{7} \; 16 \div 4 = 4 \times 11\frac{1}{4} = 44$ Amp.

Wd put on 2 201 coils of gauge
on 400 amp. 112 Volts.
900 turns

Armature 39 amp per mm

.13 X 4th

10 X 5 11 X 6

60 amperes 50 amperes.
122

6.25 1.7%
51.6
10.3 / 50

3 No 14 Wire Section total 5.4
[illegible]

153
344
612
153
459
48 0 4 3

60 / 4 8 0
8

.008

1.47
4.41
2.60

165
495

1.82
2.1
6.5
12.6 /

R 50 amperes NEW

3 Wires #16 2 times round 60 blocks

11" X 6" 248 X 152

L = 248 X 2 + (152 X 2) X 60

R = L × S.P. / S = 51.600 × .017 / 6.3

.044 + L = .055

4.09
.3.04
16.36
12.27
12 4 8 3 6

124 = 1 ohm

124 / 124
51.6
4 9 6
2 0 6 / 0.42

51.600 - .42 L ÷ 4 = .10.5

Section 248
152
3 0 6
1 3 9 0
2 7 6
4 2 2 5 6

L = (248 X 2 + 152 X 2) X 60 =
(252 X 2 + 156 X 2) X 60 = 52.560 Feet

R. = L × SR ÷ 4 = 52.56 × .017 / 2.16 × 3 ÷ 4 =

.999 / 6.42 ÷ 4 = .155 ÷ 4 = .039 ohms.

HU per square inch

C² × R / Eff S. = 50² × (.039 × 64 1/7%) / 204 effective inch = .30 HU

Wire each core $1.69 \times 45 =$

$$\begin{array}{r} 45 \\ \times\ 1.69 \\ \hline 405 \\ 45 \\ \hline 76.05 \end{array}$$

76.05 lbs.

This R machine will be perfectly good for 66 lamps of .45 amperes

Magnet 60% section + 38 amperes.

$278 \times 152. = \frac{42353}{42250}$

1"

Core ~~145~~ 177

45 ohms #18 wire

$\frac{110}{45} = 2.44$ Amperes

$38 \div 2.44 =$ 16 layers

Amperes per ~~[illegible]~~ in in

$\frac{38}{32} = 1.216$ 2.44 900

Length of Core

45 ohms = 232.6 feet $\times 45 \times .304 = 3182$ Meters

$3182 \div 2 =$ 1591 each core.

$177 + 27.5 = 201 \times 3.14 = .631$ length of one convolution

$\frac{1591 \div .631}{16} =$ no of Convol. per layer. 156.

$156 \times 1.48 = 230$ length of core

add ¼ inch each end and end tracks

Core:- 1 inch diameter

Wound with #18

16 layers

Core 10 inch long over all

EMF =

$1.08 \times \left(\frac{2\pi \times 3 \times 2 \times 60}{8}\right) \times \frac{160 \times .152}{\frac{60}{3}} =$ 80

$108 \times 33.36 \times 1.05 = 143$ Volts

$\frac{138}{356}$

Comparison of weight old R New R.

Iron. = Cores 1/3 of Cond 3841.8 C. inches

Keeper 1/10

Copper Cores 80

Armature 3.

Loss in Magnets

Change of G. 25 amperes.
in Cores

M at present = $\frac{E}{I \times V}$ =

$\frac{110}{(256 \times 2 \times 10 \times 27) \times \frac{1000}{60} \times 126}$ =

$\frac{110}{56.32 \times 378} = \frac{110}{2112} =$ ·52

Weight copper 30 lb.

Weight iron

Present percentage Section $\frac{12469}{32256}$ = ·38 %

" Current round.

$\frac{110}{62} \times 6\frac{1}{2}$ = 11·94

Say we take 6½ iron

Section wire be 165. $\frac{21392}{32256}$ 66 %

Suppose the same wire

30 lb. ÷ 20. in 62 ohm.

Current = 1·77

30 amp. ÷ 1·77 = 21 layers

·165 + 1·07 × 21 167·5 diam average

average length each convolution ·526

9 lb 2 feet = 2815 metre

1408 metre each coil

1408 ÷ ·526 = 2680 convol ÷ 21

128 convolution each layer

G continued:-

128 X 1·1 = 141 ÷ 25 =
166 length of cone.

F Machine Armature
6 No 14 Wires 2 times round
60 Blocks

Current = 1.7 X 12 = 20.4 ▨ m m
100 amp ÷ 20.4 = 4.9 amp per ▨ m m

Radiation per inch

Resistance total .616 ÷ 6 ÷ 4 = .0257
Surface 288 inches

$100^2 \times (.0257 \times 64\%) = 100^2 \times .01645 =$

164.5 H.U. ÷ 288 = .58 HU
per ▨ inch

New York. May 26 1884

H Machine. 500 amperes

Section 500 amperes at 4 per

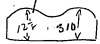
[illegible] m m. = 125 [illegible] mm.

= 62.5 [illegible] m m each side

206 = 20.88 × 3 = 62.64 OK

227

Magnet



Core 275 =

59393 × 2 = 118786

118786 / 202668 = 58%

746 × 246 = 183516

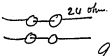
·273

= 64%

Now to send 38 Amperes

Suppose we say 12 ohms

Then



110 / 24 = 4.6 38 / 4.6 =

9 layers of 16 wire

9816 feet = 24 ohms

4908 feet each core

4908 ÷ 9 = 545 feet each layer.

545
.304
2180
1635
166000 | 134
1235 | 166000
1235
42500
37050
5450

134
2.1
134
268
281.4

10¾ diam = circum 33.77
-2.64
15508
10131
102.608

(10¾)
10.750
.707
15.547

(15.5) average
15.5
25.4
620
775
3100
393.70

Diam. 393 = circum 1235
545 feet = 166 meters
= 134 turns =
134 × 2.1 = 281 m

775
160
322
775
740.000

110 | 7.24
47 | 140
161
180

2.340
257.40

142.24
.03
4.27
142.34

92
110
10120

142.34
4.27
110
9963
2846
569.3
6089.8

110 | 7.71
14.25 | 110000
99750
10250
9975
2750

7.71
110
849.1

99.71
.728
79942
19971
69899
725.889

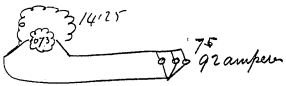
9321
99.73
29913
69797
7.29883

Distribution of energy in old H + New T

May 28 1884

1500 turns

old T



Energy = EI ÷ 9.81 × 440 = foot lbs.

EI	Lamps = 110 × 92 =	10120
	Magnets 110 × 7.71	849.1
	Armature = .073 × (92 + 7.71) = .073 × 99.71 = 7.28 E	
	7.28 × 99.71	725.89
		11694

Lamps 10120 / 11694 =	86.5	
Magnet	07.2	
Armature	06.3	
	100.0	

Dev

$\frac{110}{34} = 110 \div 3.24 = 0.94$

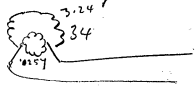
$11620 \,|\, 110000 \div 10467 = 9.42$

$11620 \,|\, 356400 \div 34890 = 10.23$

$11630 \,|\, 2730 \div 2336 = 1.17$

$11630 \,|\, 2730 \div 2336 = 1.17$

New T energy



100

Voltamperes

Lamps 110 X 100 = 11 000

Magnet 110 X 3.24 = 356.40

Armature

@ X R = 100 + 3.24 X .0257 =

E 2.65 X 102.24 = 273.50

$\frac{11000}{11630} =$ 94.5% lamps

Ma 03.0% magnets

02.3 armature

9658 / 87000 / 0.0.8

768640

61360

57942

3412

112

75

8300

9658 / 862200 / 0.09 / 7.7

112

75

8400

7700

8624

82.71

.073

24813

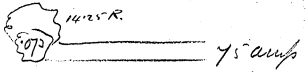
57897

6.03 / 583

82.71

496.26

Old T =



112 Volts

Lamps 112 × 75 =		8300
Magnets $\frac{112}{14.25}$ × 112 =		862
Armature 75 + 7.71 = 82.71		
82.71 × .073 =	6.0	496
6 × 82.71		
		9658

Lamps $\frac{8200}{9658}$	86.3	
Magnets $\frac{862}{9658}$	0.9	
Arm. $\frac{496}{9658}$	4.7	

	Old T %	Mar.
Lamp	86.3 %	94.5 %
Magnet	0.9	3.2 %
Arm.	4.7 %	2.3 %

14665
2514
58625
7333
2
37 2 ~~[illegible]~~ 10 | 195 | 7

14.0000
1665

222
2
2

240350 | 58535000 | 6.24
48070
10465500
9614400
0.41

240350 | 99950 | 0.41
96114
2840
45.6

A | 10
34 | 503 | 34 | 6

110

30 15
E
4 | 110 | 1168 | 220000 | 190
1168
10320
10512

250 ampere
300 turn –

Armature section per
18¾ × 20 long.

300 light core = 18¾ = 27 58535 / 240350 24%
415 × 506
6225
2075
210075

Suppose 355 99950 / 240350 41%

45 amperes ÷ 7 = 7 layers
say 15 ohms.
110 / 15 = #14 = 667 ft per ohm
15
3335
667
10005
1334
9 0 0 2 0
3 8 0 1 5
5 0 4 1 0

or 1520 meter each core
3½ mm = 1.168 each convolution
1520 ÷ 7 = 220 ~~[illegible]~~ meter each
220 ÷ 1.168 = 190 turn × 2.5 =
25
950
3800
4750 = 18¾

250 Ampere machine
300 turns

Armature Iron .507 X .475
~~48 divisions~~ —
2 loops #11 8 each.

Amperes per in in ▨
2.1 amp per ▨ in in

Resistance = 4.4 ÷ 8 ÷ 4 = .137

Heat radiates
C^2 X R X 52% ÷ Surface =
4437 ÷ S =
4437 / 1175 = 4. HU

1. X L X V = E

1 X .507 X 2 X 48 / 5 X 800 X .475 / 60 =

1 X 48.7 X 2.375 = 115 Volts

13.94
1300
6970
418200
42.5170
16

.507
.507
.475
.4664
1992
3.944
31422
15712
4.1850
188.5

42.5 | 1900
1700
2000
6

42.5
2.375
48.7
6625
19000
9500
115.6625

8 | 4.4
4 | 0.55
0.137

8 | 4.4
0.55

.507
1.014
8.112
4056
4.8177

1395
1.304
5580
4185
424000

8/56
4/107
011 9

62500
.0075
31250
43750
468/5000

50/14
10950
19064
3 19 64
1 5 7 6 8
2 5 1 3 9 2

62500
56 2500

424 | 25100 / 21200 / 3900 / 3816 | 0.59

1395 feet = 1 ohm = .424 metre

190 Metres

424
190

424/1800/0.45
2040

.45 ÷ 8 ÷ 4

8/.45
4/05 75
0.1 4 4 Resist

.014
45
56

CO_2 X R X 52%

62500 X .0075 = 468
1175/4680/0.4

62500 X .009 =
1175/5620/0.5

2000 lb 011

48

6194.6

250
80
12500
50000
6250000
10727
4375000
6250000
7937500

7.292 / 87.48 | 250000 / 17496 / 175040 | 2.8

6.59
4.0983
.0245

.0244
1.044
4056
6084
6.8890

.0245
.52
890
1225
.01290

250 Ampere Slow speed

Suppose 64 blocks
& 6 wires 2 times round

∴

Amperes per mm will be 2.8

Resistance = .59 ÷ 6 ÷ 4 = .0245

Heat U.

$C^2 \times R \times 52\% \div 1175 =$

493
1175 | 7930 | .6740
8800

$1 \times \frac{.507 \times 2 \times 64}{2} \times \frac{.245 \times .475}{60}$

65 × 2.375
65
11875
14250
154.375

14

154 Volts

June 2

Slow speed 250 amperes.

Magnet

10% core = 24% section

Multiple arc the cores —

We want 80 amperes through there

10 ohms total = $\frac{110}{10}$ = 11 amperes

~~00~~ $5\frac{1}{2} \times x = 80$ amp

$x = 15$ layers.

each core

20 ohms

15 layers

$5\frac{1}{2}$ amperes

Say just #14 wire nearly

2 amp per m m

Then one convolution =

$.273 + 2.5 \times 15$

$.37$

$.310$ 310 cent. = .974

Length

20 ohms 667 feet per ohm

$667 \times .304 = 203$ metres $\times 20$

$15 \overline{)4060}$ each core

271 each layer

$271 \times .974 = 279$ Convolutions per layer

$.974 \overline{)271.000} \quad 279$

1948

7620

4792

$279 \times 2.5 = .697$ length of Core

279

15

1395

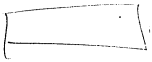
558

697

1758 / 12.000 / 1758 / 6.1

15
750

12716 / 12.000 / 2.4 / 7.5



700

Slow Speed 250 amp
See what we get with the
wire that is in

Arc lamp machine June 3 1884

Lake 50 light machine —
Wind armature with

June 6 1884

300 Rev. 250 ampere

Now we have supposed armature 6 #11 wires 2 time round + 64 blocks

Now how does the answer the requirements?

{ 1 Resistance = ·0026 Resist

{ Resistance effective = ·0026 × 52% = ·0135

{ Amperes per mm = 2·83

{ Heat Units per inch surface $\frac{C^2 \times R \times 52\%}{1130} = \frac{944}{1130}$ ·72.

Now experiment shows me that I must have 50 per cent section at least and 45 amperes of current

Now if we take 14 nos

which is 355 Diam + Section

98980
231699 43%

15" = 380 = 113411 = 49%

Will take 14" 43%

Now to pass 40 amperes current
#16 Wire in 10 layers

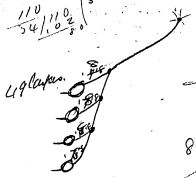
355 +
18
373 = 1.171 one convolution
Diam

27.5 ohms = 124.4 X 27.5 =
3421 meters each core
or 342 " " layer.
or 292 convolution per layer
292 X 1.87 = 534 diam. or
21 inch 22" over all

Now suppose we say 14" core
and 5 amperes current.

5 amperes X 10 layers.
#15 = 2.1 diam.
Current 5 Resistance 22 ohms.
11 ohms each ~~layer~~ core
502. feet per ohm = 152.6
Diam 1 convolution 3.75 = 1.178 Circ
152.6 X 22 3357 meters
= 1678 on each core
or 168 on each layer
168 X 2.1 352 or 14"

110 / 54 | 110 / 102 / 80 | 3.2



3.2
12
38.4

80
80
640

.76 / 38.40 / 49
31 2
72 0
72

Drain .81

□ .397

22 = 76 feet per Ohm

Drain = 80 + .81 × 49
40
120

49
81
2 6 4
40.57

120 = .377

1564 meter each core
32 meter each layer
90 cover.
90 × .81 =

100 ampere machine
Weight of cross & Keeper
Weight of head
total

179
330
5370
5370
6107.0

50 = 1963 × 5 = 9515
80 = 5026 × 4 20106
6400 25600

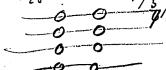
46
46
8

.304
76
1824
2128
23104

23
65
115
138
1564

110 / 3.2 = 134.33 / 32 / 98

3 · □
1.5 / 1.5
.20



68 ohms on each

80 / 1564 / 32

377 / 32000 / 3393 / 90

July 18 1884

Alteration on the S.

Can we put more section on the Armature.

~~·246 × 3·14 = ·772~~

·64 division at ·042 =

9.69 × 3.14 30·426

·042 × 64 = 2·688

64 | 27·738 | 0·434

256

213

192

212

·434 in each division —

#16 = ·065 + 20 = ·085 × 5 ·425

#15 = ·072 + 20 = ·090 × 5 = ·450

10 #16 = 42250

10 #15 51040

Drain 9.690 × 3·14 30·426

64 division at ·042 2·688

27·738

27·738 ÷ 64

·433 — space for each

#14 8 = 55112 ample

·083 + 20 = ·103 × 4 = ·412

∴ We use 8 No 14 wire instead of 10 No 16

Percentage Section —

Armature ·419 × ·246 = 103074

Core ·234² × 3·14/4 = 60800

= 41%

If we take 11" core we have

2·48² × 3·14/4 = 4772.84 =

= 45%

If we take 10 core

2·54² × 3·14/4 = 50645

= 49%.

If we take 10½"

2·66² × 3·14/4 55544 =

= about 53

If we take 10¾"

2·73² × 3·14/4 58505.

= 57%

Now for the wire 20 ohms resist

~~44 8 amperes.~~

= 110/20 = 5·5 amperes

About 8 layers

Amperes layers
5.5 X 8 = 44
We b carry 5.5 amperes at most
more than 3 amp per m m =
#16 =
20 ohms #16 = 409.276 feet X 20 =
409.276 X .3048 X 20
2450 metres of wire
12.40 each layer
155 metre each layer
Core 273 X 3.14 857
155 ÷ 857 181 turns to layer
.079 X 181 = 14.3 inches long
14.3 + 1 = 15.3 total

~~Amperes spires~~
~~in old 200 S.~~
~~$\frac{110}{14.06}$ X 277 X 11 3/4 =~~
~~7.8 X 277 X 11 3/4 239.220~~
~~in new. 200~~
~~5.5 X 8 X 181 X 2. 15.928~~

old S. 94 lb 7 each = 28.3 ohms
or 56 ohms.
In multiplying are the ampere spires
ought be. 12.690
~~7.8~~ X 277 X 11 3/4 ~~25.381~~

Take #16 wire and ~~[illegible]~~ 30 ohms
78.8 lbs. each core
30 ohms = 409.3 X 30 X .3048 =
3743 metres =
1871 metres each core
3.66 X 11 = 40.26
11 layers.
1871 metres ÷ 11 = 170 turns each
170 turns X 2.1 = 357 m m length
14 1/5 inch
with insulation 15 5/8.
Ampere spires :-
3.66 X 11 X 170 X 2 = 13.688.

Take 94 lbs #16 =
.1268 X 94 = 12 ohms about
Amperes $\frac{110}{12}$ 110 = 9.17 amp.
#18 = 2.486
9.17 ÷ 2.486 = 3.7 too much

Suppose we take same wire
194 lb. #14 = 28·3 ohms
56·6 ohms

altogether
326 × 56·6 × ·3048 = 5624 metres
2812 metres each wire
10 layers: would be 281 metres per layer
273 × 3·14 = ·857
281· ÷ ·857 = 328 each layer
328 × 1·83 =

---

12 layers = 2812 ÷ 12 = 234 turns per lay
231 ÷ ·857 = 270 turns
270 turns × 1·83 494 or 20 metres
Ampere ofwire
7·86 × 270 × 12 = — ~~254664~~ 12752

Amp layers $\frac{7.86}{2}$ × 12 = 3·93 × 12 =
46.16 —

Suppose we say 110 lb #16 each wire
= ·191 × 110 = 21,010 ohms
$\frac{110}{21}$ = 5·24 ampere
length ·409 × ·3048 × 21 = metres
2617

---

110 lb. #16 each wire
220 lb. wire = ·191 × 220 = 42 ohms
$\frac{42}{4}$ = 10·50 ampere

21 ohms each wire
409 × ·3048 × 21 = metres 2616
in 12 layers = 218 ~~metres~~ —
273 × 3·14
218 ÷ ·857 = 254 turns
254 × ~~2~~ turns ·508 or 20 metres

Ampere ofwire
$\frac{10.50}{2}$ 12 × 254 =
5·25 × 3000
15750

Then we say

10 ¾ core 20 inches long

Wound with 12 layers

No 16 Wire 110 lbs each

core

The 175 ampère machine

with 300 revolutions 110 V.

4 wires #11 = 7.3 × 8 =

58.4 m m

$\frac{175}{58.4}$ = 3 amperes per m m

Good

1.07 m m = insulation

1.07 × 64 = 68.48 m m

3.56 m m each wire

Diameter =

$\frac{68.48 \text{ mm} + (3.56 \times 4 \times 64)}{3.14} =$

$\frac{979.84}{3.14}$ = .312 diameter

[ITEM FOUND IN BOOK]

12 #11 Wire = 87.6 m m

m m □ 4.3 × 12 =

87.6 / 250 = 2500 / 1752) 2.83

2480
7200
2720

2.83 Amp per m m.

8 #11 Wires = 58.4

58.4 / 1750 / 1752) 3.

.042
2514
168
210
.0668

Drain 460 × 3.14

314
1840
460
1380
144440

.042
64

1.07
64
428
642
68.48

120
20
1140
2514
5660
700
2800
3.5660

Charles Batchelor Notebook, Cat. 1305

This notebook contains dated entries for the years 1885-1886, 1891, 1897-1898, and 1909. There are also a few undated entries, probably from the period 1879-1885. All of the entries are by Charles Batchelor. The notes, drawings, and calculations relate primarily to experiments on lamps and dynamos recorded between 1884 and 1886. Some of the material from 1891-1898 pertains to ore milling experiments. The undated entries include notes on the Edison-Sims torpedo motor and on patent interferences involving the telephone. There is also a copy of a telegram from Batchelor to Edison concerning the formation of the Edison United Manufacturing Company. The front inside leaf is marked "Mechanical motions Mch 10 1879." The book contains 52 pages, numbered by an archivist. Many pages have been cut out of the book.

BURNTON'S
No. 32
FOURTH AVENUE
Near 9th Street
N.Y. Mass.

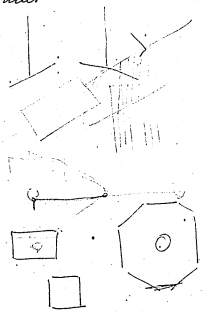
Cat. 1305

Mechanical motions

Oct 10 1879

E5795.5

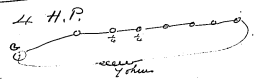
The wire round the armature are No ___ wound ___ together in ___ turns of each of ___ coils ___ the resistance of each coil is ___ ohms making when taken off at the brushes ___ ohms



Schuyler says: Edison has yet to learn that increased resistance requires increased power.

Edison has a lamp of 100 ohms and gets 90 volts

Schuyler 4 H.P.



4 ohms

What per cent of energy do we get

The Bunds takes 3200 ft lb

660000
64000
33000
3200

20 H.P. — 33000 × 20 = 660000 / 20

4 Machines loss in Journal friction 10 p.c. 99 000

Loss in Engine 15 p.c. 66 000

Loss in Bunds 16 000

100 / 133 = 75 p.c.

8 p.c.

Telephone:—

Berliner patent 1878 Jan 15
filed Oct 16 1877

1 Claim:—
Carbon plate and points used
as a receiver.

Irium patent July 23 1878
page 345. Fil. June 12 1878.
Carbon points as a receiver
when adjusted right

Bell page 464
Transmitter of pictional
surfaces. etc

Make transmitter of Carbon
with hole in and platinum
wires through.

Make transmitter of fine wires
laying over a bridge.

Cook 628.
carbon as a receiver

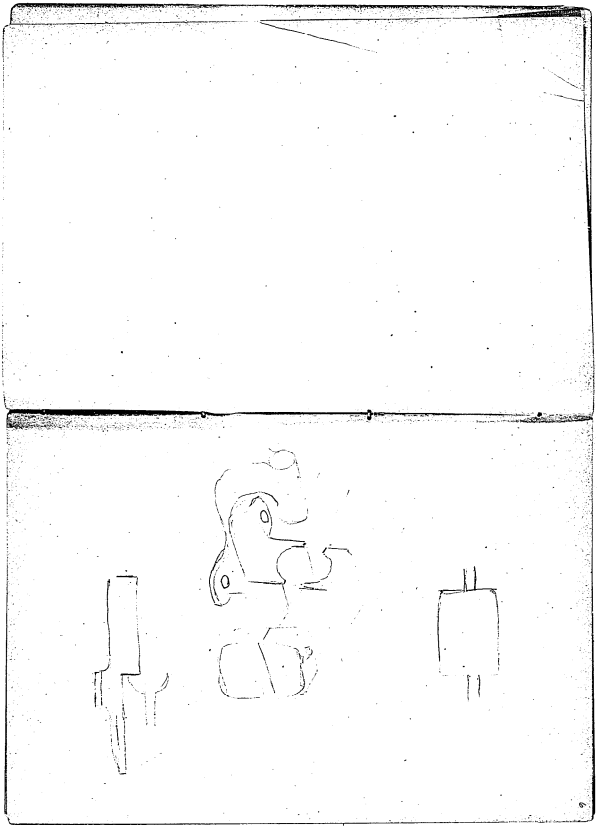
See 742 Telephone Circ.
~~Automatic~~

796 Automatic [illegible]
Westinghouse
also 848

the Waton machine for 200 Amps
70 Volts
1000 Rev.
Resis Armature ·0011
" Magnet 24 ohms.

Take no 200 amp Machine

Sim. Torpedo motor -
1151 Dynamo per minute
3814 ÷
636

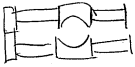


168
168
42
378
144
1512
1512
1632

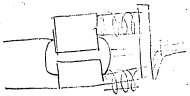
3.14
6
18.84

378 | 18.844

378
50
1890



98
9
107



$\phi = \frac{300 \times 2 \times 2 \times 50}{50{,}000 \quad 120} = 50$

$V = \frac{1600 \times 160}{60}$ 4.27

4.27
30
128.10
19
115.29

120 Ampere 21.195

6.75
3.14
2700
675
2025
21.1950

200
1442
48
5536
1768
21216

2015 10.25 000

13.14
3.14
5256
1314
3942
41.2596

R = $l \times \frac{10.34}{s}$ =

$l = \frac{24.5}{13.14} \times 2 \times 54$

339

123627 | 350500
247254
103246
94444
400400
16000

0·0283
0·0071
166
426
426
0·00468

0·00468
2686
4030
4030
4

1070 | 0·074

#1 Nov. 23 1885 9

High volts on Siemens' Armature.

I have noticed that when we have a cross on the municipal armature it is always at one place, that is either between first + last coil on top Carbon or ~~bottom Carbon~~ between first and last coils in bottom Carbon, at these points the difference of potential is 1000 volts. The Siemens armature has ~~the~~ the disadvantage that some of its coils lying next each other have full volts of brushes between them. It is not so with the Gramme ring, on which the full volts is only found at brushes, & between the coils there is only the E.M.F. due to the ~~armature~~ number of turns on commutator — It might be therefore well to make an armature such as in drawing

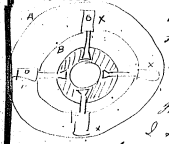
This was patented some time ago by Edison + Cabella of Italy has taken it up + made some ~~good~~ machines

Shear. There is one thing however that is bad, & that is that the whole thing is clamped up on shaft like a commutator & so if it generates much current the leverage is so great that I should think the insulation would not hold, but it would allow the whole thing to turn on the shaft. Cabellas idea is to make the pieces & insulate from each other & then clamp all up together on shaft; after this he insulates the inside of the body & winds it full of wire & attaches the cross piece of copper on top in some way or manner. (I dont see how he does it without taking up room)

If this were a good practical thing the chg. between any two cores would be regulated by the number of commutator bars

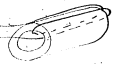
Crompton has made a similar machine called the Crompton-Kapp. dynamo where discs are used instead of wire for the iron of armature. Iron supports

braces are dovetailed ~~into a~~ sideways into a collar on shaft and these are fastened to pieces at X which are placed at intervals in the armature. The plates I suppose are secured by bolts through the pieces at X — the wire at A has a certain number of layers ~~section~~ ~~to shape~~ the inside wire at B has a greater number ~~section~~ ~~to a different shape~~ to allow it to be got into a smaller space. He also makes one of bars of copper having larger section than the others. I should like to see the details of connecting these different ends of the bars & their connection to the commutator as in these things depend the success of any machine made like this.



Siemens made some years ago a machine similar to this only in the shape of a flat ring. It is described in the Electrotechnische Zeitschrift.

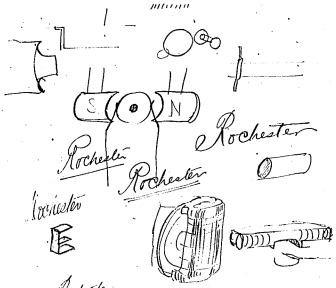
making this wound he armature so as to have ~~only a minimum~~ the fewest volts between each coil in armature —



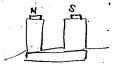
It seems to me the method for making a drum armature so that the coils should not have many volts between each other lacks the ~~the~~ essential of strength & solidity to do the work. However for Municipal lighting I think we ought to endeavour to to wind it as a drum ring instead of a Siemens winding —

~~Lel. Dyn for Cincinnati~~ Dec 2. 1885

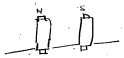
~~1 line 15 inst. 6 colum = 35.=~~ line



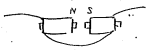
Experiment –



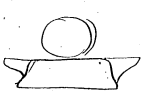
Strength of magnet

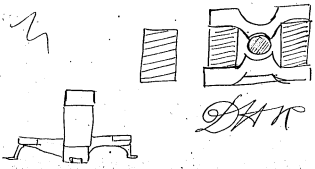


Strength now?

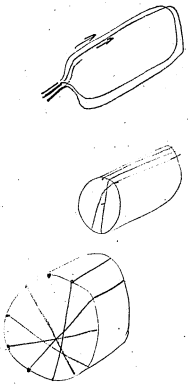


Strength now?

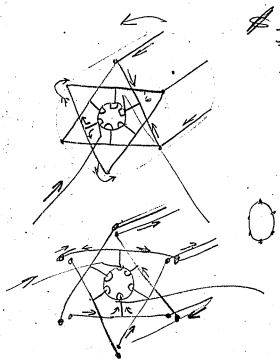




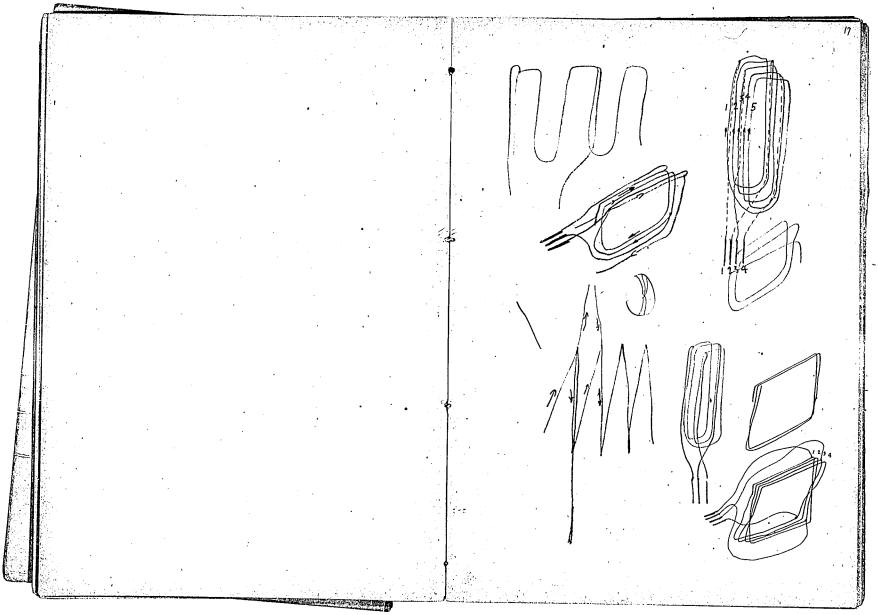
DHK

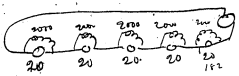


3200



S
N





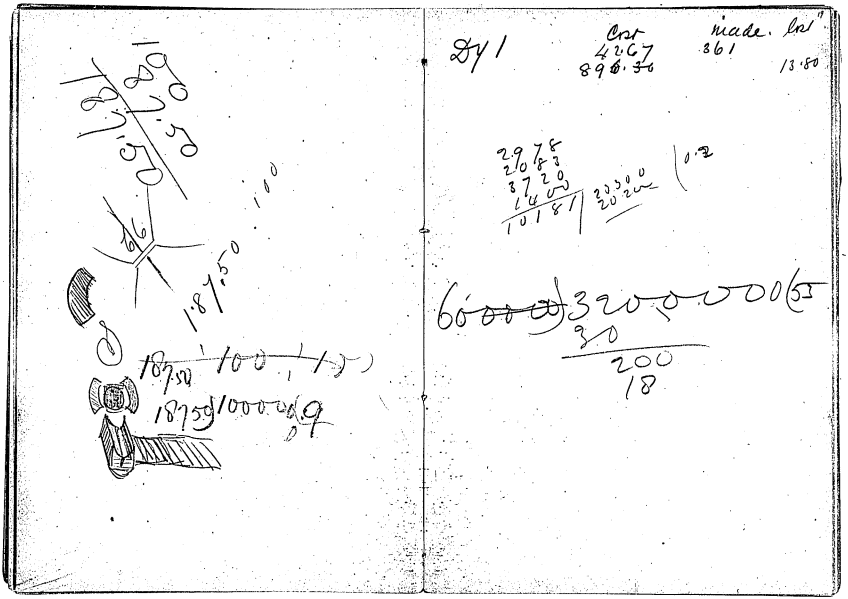
182 ohms each or
910 ohms in all

$\frac{100}{910}$ 100 | 0·11 amps.
910
900
.20 V. fall drop in each

If one lamp goes out resistance =

182 + 182 + 2000 + 182 + 182 =
182
182
182
182
2000
2 | 24 | 20000 | 0·73 % or 73 V on terminals of one instead of 20
19096
1000

whereas the energy passing through the 2000 ohms in one case would be ~~2000 ohms~~
$\frac{20}{2020}$ the + in the other


Cost
4267
made. lost
361
13.80
29 75
20 83
37 20
14 00
101 81
23300
20200
10.2
320
30
200
18
187.50
187.50

48400
146200
290.400

4 #5

48400
387200

716400
286.400

500 | 387200
776 -

.88
.12
.042
1.042
52
2084
5210
54184

3.14 | 54.184 | 17.25

500 | 402486
805

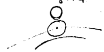
Dec 24th 1885 20

<u>500</u> <u>Ampere</u> Dynamo
125 Volts 700 to 800 speed.

800 circ mils to ampere =
800 x 500 = 400,000 =
4 #5 = ~~total~~ of 387,200 circ mils
or 776 per amp.

4 #5 = .22 x 4 + .030 x 4 + .042 =
.88 + .12 + .042 = 1.042 x 52 =

$\frac{54.184}{3.14}$ = 17.25" diameter through centre of first layer wire



.220
.030
.010
.260
.520

17.25 - .520 = 16.73 at bevil

No good.

Try 3 #3

Circular mils = 402.486
805 per amp.

116) 48.256 | 15.37
31 4
16 8 0
15 7 5 6 2
1 9 4 0
9 2 1 4 0

.259
.024
.316

.259
.292

Diameter

3 wires = .259 = .777
3 insulation .033 .099
1 division - .052 .052
52 blocks .928
52
1856
4640
Circum. through center first layer. 48.256

48.256 = 15.37

.010 .292 3.14
.010 .006
.002
.012

15.37 - .316 = 15.054"
.316
15.054
add 1/8" & 1/16 .125
062
Inn. Actual diameter 15.241

800
500
400000
666.66

716
500
358000
179.000
59.700

220
220
1476
984
492
60516

244
244
976
976
488
59516

240
240
9600
480
57600

245
245
1225
980
490
60025

Diameter of armature =

$$
\begin{array}{r}
.245 \\
25 \\
\hline
.270 \times 3 + 050 \\
3 \\
\hline
.810 \\
.050 \\
\hline
.860 \\
10 \\
\hline
.870 \\
.66 \\
\hline
5220 \\
5220 \\
\hline
3.14 \overline{)57.420} \quad \Big| 18 \\
31\,4 \\
\hline
260\,12
\end{array}
$$

25000 / 12 0000 / 0.50%
12 5000
50 000

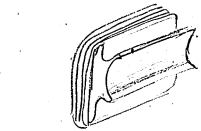
$\therefore \times \frac{54}{100} = 50.0$

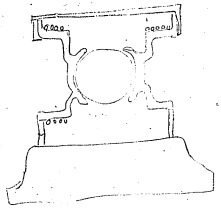
54
3780 00 / 90
4 8 8
1 2 0 0
1 2
6

250.00.00 250 Sh. 100%

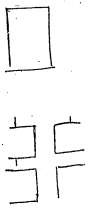
@ B.	4000
J. K.	4000
L. Yay.	4000
S.D	500
Teacher	500
	13,000

@ B.	4000
J. K.	4000
L. Yay.	3300
L Yay.	700
D.D	500
Teacher	500
	13 900





Mch 24 1886



W K Freeman Brooklyn

302 557 1884 filed
Nov. 1883

Displaced Core

Apl 15.	Bell Tel		96 ✓
July 15	"		96
Oct 15			96
Jan 15			96 ✓
Dec 1	B T C	600	
Mch 1	" "	600 ✓	Tel every month
		600	100
June 1		600	
Sept 1		600	Pan
Apl 1	Sample C	250 ✓	
July 1	"	250	
Oct 1		250	
Jan 1		250 ✓	
Feb 1	Illy C	55 ✓	
May 1	" "	55	
Aug		55	
Nov 1		55	
Jan 1	4	130 ✓	
Apl 1	"	130 ✓	
July 1		130	
Oct		130	
Mch	"	202 ✓	
June		202	
Sept		202	
Dec		202	

June 29 1881.

3800	4½	
500		
6256		
750		
2500	4.5	20,0000 4444
2800		750
1000		200
400		150
		200
22,006		4444

134,000
536,000

		Jan 16	Jan 16	
	Tel	219	Jan 16	
Jan 400	Jan	100 + 96 + 250 + 130		= 566
Tel	Feb	100 + 35 Illy C		= 135
	Mch	100 + 200 + 202		= 902
	Apl	100 + 96 + 250 + 130		= 566
	May	100 +		135
	June	100		902
	July			566
	Aug			135
	Sept			902
	Oct			566
	Nov			135
	Dec			902
				6,412

1000
1400
522

56000

3820 at 10% Laylor & Co	6412
E.M.W. – 134000 at 4%	5360
E.M.W. Salary	5000
E.M.W. 40000 at 7%	700
	17,804

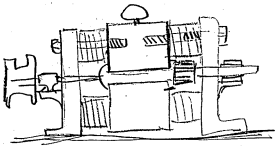
Edwin Fortmyers.

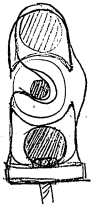
Would you favor plan of shops taking Isolated business except lamp renewals and Isolated giving out of existence shops from a selling department which pays 2% of net shop price of everything to Light Co & half profit of selling department – price ~~of~~ to selling department being present shop prices – ~~[illegible]~~ If cash made by selling department each shop to pay one third – selling department loss to be made up before division of profit with Light Co

Batchelor

JB Woods.

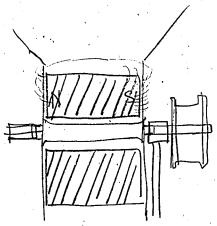
Jan. 13 Tel.
Lamp Co





N
S

1 pair	Ham 1 card	4 flush	4 straight	3 o	3 of 1 card	2 pair
0 3°	0 00	0001	1000	000	00F0	0000
6-2p.	0 000	1000	000	0000	0F00	00F0
2222	0 200	0001	00	0000	00F0	F000
23000	0 30	0000		0000	4000	0
3 0022	0 00	0001				
0003	0 20	0000				
0002	0 00	0001				
0023	0 30	0001				
0022	0 00	0001				
2033	220	0001				
0022	00	0001				



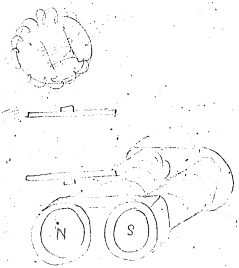
Mg per Ag.

31·68 / 299·95 | 9·46
28512
14630
12672
19580

450 × ·066 = 13.
·066
2880
2880
31·680

20·67
9·46
12402
82268
18603
195·5487

14411
·0208
115288
28822
299·7488



Radiation of a metal in a battery
Passing a wire in front of a magnet.
Heating two dissimilar metals at their junction

1 grain = ~~[illegible] Milligrams~~
0.06375 Milligrams

Urin 10 Pyrogallic Acid ·637 mg
75 Carb Soda 4.965 4.781 mg
170 Sulph Soda 7.905 7.004 mg

5 | 450
90
32
12.2

5000 / ·008240 | 0.00165
50000
32400
30000
2400

5000 / 0·151.60 | 0.0303
15000
1600
15

Oct 24th 1891

#6 + #7. To determine relative amt of Sulphur. —

each 1 Grammes.
20 cc Nitro Muriatic Acid

480 / 15434

480 / 30.5944 | 063·7

2880
1794
1440
3540

·06375
75
31875
44625
4781·25

660

·0530
0·13
·166

·0530
132
·0662

0.0662
75
3310
4634
4.9650

·0662
110
7.2820

·06370
70
·00070

#6

1 gramme Washed

·011 of Sulphate Baryta.

·011 × 0·13734 = Sulph per gramme

·13734
·011
13734
13734
·0015107 Sulph in one gramme
733920

1000 / ·0015107 (0·0000015
1000
5107
5000

1½ mg in each gramme

·13734
·06
·0082404

1000
150
1000

·13734
·150
123606
96138
·0206006

·13734
1·105
54936
13734
13734
5·16236

5·000 / 0·10850 (0·0000217
10000
8500
5000
35000
35000

·13734
1·105
54936
13734
13734
5·16236

·0000217
5·000
·0001085000

Troy grains 0·8 = ·053 gr. ∴ 1 gr = ·066 nearly

Therefore 1 lb = 12 × 20 × 24 × 0·066 grammes
= 366·960
2000
733920000

1 Lm = mg. 2000 lb of ton

#6 Carries $\frac{150}{1000}$ of 1% Sulphur.

10% 5·0000 / 0·1085000 (0·0217
1% ·500 / 1000
·050
5000
5000
35000
35000

5·0000 1085

5000 / 10850 (0·021
100

·68%
100
·068
1·000

·108

0·021
50
1·050

5000 / 10850 (0·0217
1·0000

5000 = 1085
1000 21
100 2

·0217
100
2·1700
·1085
50000

× 0·13734 = S

#1 =	·790 × 0·13734 =	·1085	S = 2·17 %
#2 =	·060 × 0·13734 =	·00824	S = 0·165
#3 =	1·105 × 0·13734	·1516	S = 3·030 / 1·000

In this #2 & #3 there may be other matter as I did not acidify before ppg last time & so I dissolved out by HCl afterwards. I have kept them & will purify

Canada Mine May 5th 1891

#32 from 19c. line

1 20 grammes material ground 50 mesh

20 " #2 } Concentrate
#3 } Tailings

Amount of sulphur in all the last two ought to equal the 1st

May 10 Put 5 grammes of each in 100 cc of Nitro Muriatic acid 6hrs

1 afterwards at 50c for about 12 hrs

2

3 evaporated to dryness.

#1 - 0·790 Susp Bangles

2 - 0·060 " "

3 1·105 " "

May. 6 1891

Kodak. #2

1 Cupboards & Mirr. on table — Cloudy outside 1 sec

2 " " " "

3 } Magnet table & Bookcase. — Bright 1 sec
4 } " " " "

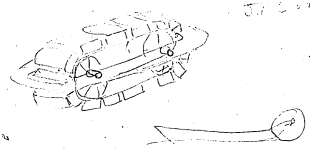
5 View from hand of Bookcase — Bright Sun — Snap shot

6 View from cupboard shelf — Bright Sun — 20 sec.

7. Snap shot from my bedroom window — Bright Sun

H is $\frac{1}{11.162}$ of water — ∴ $\frac{1}{10000}$ of the body wt.
for vol. about

Hutton's dict. Article Aerostation
previous to 1835
much information



Tests #25 May 26th 1891

Blue quartz sprinkled with Pyrites

Mecn. - nothing but pyrites Iron -

Took. 30.gr of dried 80 mesh. + washed.

Assay. 26 May 24 1891

Quartz rock with black ore in (looks like iron) & small specks of free gold – Some of the black material has a bronzed cast

Also. a material looks like galena

1 troy grain = ·066 grammes

1 gm / 1 ton 2000 lb. X 12 X 20 X 24 X ·066 = multip. 760320.000

760320 gr. ÷ 52.760 g. = about 14411

∴ ·0208 gr X 14411 = Weight of gold per ton
= 299.750 grammes

Value at $20.67 per Tr. lb =

1 lb. Troy = 31.68 gram. = 299.75 ÷ 31.68 = lb. troy per ton 9.46 lb. of

9.46 X $20.67 = $195.54 per ton

Crushed 52.760 gr. to 80 mesh – at the last the free gold was left on the little lot that would not go through

52.760

Free gold ·026 X ·8 } = 0·0208

of the remainder about ⅓ dissolved in Nitric Hy. Look. 5 grams

+ pt to wit Sulp. Hydrogen

Residue #1 from Hy NO3. – Pp. 1 black Filt. #1

Filt. 1 may contain Groups I-IV. – Acid reaction
cried to expel HS

HNO3 added – color slight yellow

NH4OH " Brown pp.

(NH4)2S. " 2 distinct pp. 1 white or grey & 1 Black.

For Groups III & IV & dont care for 1 & 2.

Filt & added NH4Cl
NH4OH. Bronzed pp.

then " (NH4)2S. Some black pp. #2.

Pp. #2 dissolved completely in HCl.
heated to expell H2S. & added HNO3

Iron

Pp. # Contains then any of these
Pb, Bi, Cd, Cu, Hg, Au, Pt, Sb,
Sn, As.

Pp is dear black so very likely
Pb, Bi, Cu, Hg, Au, Pt + Sn

Take small one add little water + 20 drops
of $(NH_4)_2S$ warm. does not dissolve —
Dilute with H_2O filter & add HCl
in excess pp. pure white turbidity
which means absence of Au, Pt Sb
+ As

Now the pp. (black may be)
Pb, Bi, Cu, Cd, Hg.

Test of 26 for silver

Boil with HNO_3 - dilute - filtered - No ppt with HCl.

Boiling Nitric M. - dilute - excess of HCl.
add H_2S. Black ppt. { Lead Hg.
Cu. Bi Cd.
Au Pt Tin Ant
As

Add Am S., + filtered
add HCl + excess + milky yellow ppt
filtered off: it's Orange yellow showing
Cu or Sb.

July 8
Took some of the black material + heat. Hot HNO_3. - all dissolved except a little Sulphur. No Silver, Lead or Hg.
Not H_2S. No ppt. No Pb. Bi, Cd, Cu, Hg, Au Pt, Sb. Cr, or As.

#26 Solution in Capsule
Sol. treated with H_2S. + want treating by Table 18 for Co. Ni, Fe, Cr, Al.

#24 In Silver

Boiling N + M. Acids filtered —

H_2S. + Black ppt. afterwards yellow — very small

S. Am added + filtered + HCl added to excess.

filter weigh ppt 4

~~Took~~ ~~[illegible]~~

~~[illegible]~~ 4 oz.

Took 10.000 gr. of Crushed ore & treat with

N.M.ac. —

#23 Dolphin May 31st 1891

#24 Sulphur May 31 1891

#
1 — 5 grammes in 100 cc Nitromuriatic Acid 5 hrs
2 = Heated to 50° for 12 hours
3 = Evaporated

20/.91

On Sept 8. the SS City of New York succeeded in Carrying mails in Pneumatism from Japan inside of twenty days

Japan Aug 29.
Company Inova
Yokohama & Tacoma
4750 miles. Qd. 19. 24 m.

Cun Pac & N.Y.C.
2850 stat

C & N.Y.
2800 miles

or about 10000 miles in 20 days or an average of 500 in per day

---

#
5000 Insulin Sept 27.
3000
600 Oct 1st Tinc

8629
426
9049
320
9729

#28. Sample from D. Jaycocks farm Putnam Co. N.Y. — It is from brow of hill where the Slate crops up — This sample is from between the Granite and the Slate trap

Under Micro — greenish, crystalline, laminated, material next to the slate trap

Dark green mass of slag — streaked in places green & black

Shiny black bright metallic mass looks like Magnetic Ox.

29. Sample from farm of Δ Jay Cooks
Putnam Co — + picked up near
where 28 was found —

Cream. Hard, heavy, granular rock
blackish like iron ore — peculiar
rich red where weathered out
nearly color of Cinnabar

Micro — Considerable iron

30. Sample from RR property PCo
This roadcrock showed me for a time
~~pit~~ rock – Looks like a silver bearing
ore.

Made Sol HNO3 June 9th
~~to~~ Ag –
either Ni Co, Fe, Mn, Zn, Cr, Al2,
Solution of N M acid

Exp #1 – Moved mg Ores without vent
Baking gradually – the object being to
keep it at 100° 1 hr + increase 50° + keep one
hour on each until 500°

time	temp	average		time	temp		
12.06	70			4.21	390		17
12.21	126		1	4.36	398		18
12.36	176		2	4.51	418		19
12.51	184		3	5.06	422		20.
1.06	188		4	5.21	422		21
1.21	190		5	5.36	494		22
1.36	180		6	5.51	500		23
1.51	220		7	6.06	500		24
2.06	240		8	6.21	500		25
2.21	240		9	6.36	500		26
2.36	240		10				
2.51	240		11				
3.06	272		12				
3.21	314		13				
3.36	324		14				
3.51	330		15				
4.06	360		16				

31

Mo

So

Molybdenum Nov 4 1897

Ore from Edison N.J.-

Ore weighed 369 nails - 347 = 20 gr -

Expt 1 Apl 1898.

·16509 gm. Silver dissolved in

a. Nitric Acid + Water – slowly but on application of heat very quick

b. Heavy milky precipitate with HCl – collected + dried weighed ·2300 milligrams

c Fused with Carb Soda, washed + separated + metallic silver

150 mg + ammes

3

Exp 2. Apl 1898.

A. Y. Minnie Concentrate

Granulated, greyish black looking ore, heavy, having some dull & some shiny grains,

Powdered some to 80 mesh. in iron mortar

Put a little 80 mesh in glass tube sealed at one end & heated it. At a moderate heat no change. At a red heat strong Hydro Sulphuric Acid smell and yellow looking liquid about ½" from ore and cloudy white for an inch above

Probably #1 Sulphur

Heated with inner flame – Strong Sulphuric Acid smell and white incrustation – Powder remains about as before.

3

Ovation Water Apl 6 1909

Apl 6th 300 cc in long tube

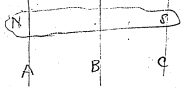
" 7 270 " " " "

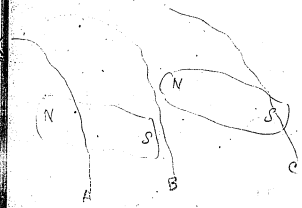
If the one was in linear as

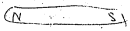
in A all +

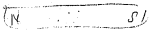
" B all zero

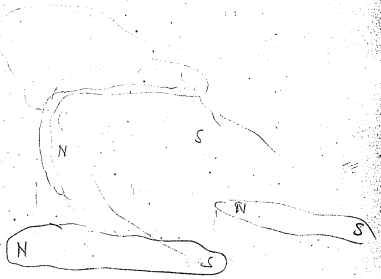
" C " —









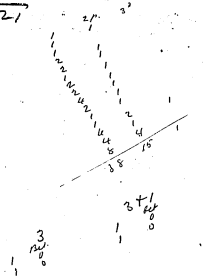

N
S
N
S
N
S

1	2	3	4
0	0	227 2277	AA AAA
JJ JJAA	QQ	10 10	6610
1010	33J 33AA	101044	66K
0	1010 101088	10	Q 99
0	A88. 8844	22 2299	0
22K 22K	0	444 444	0 0
JJ	0	AAKK	0
0	0	0	0
4T	0	A AA	0
QQ QQ	0	11K K	99 999
0	0	0	0
JJ	QQKK	33T	0
Q77 77	10105 101055	45T 88.	0
QQ7 QQQ	2223.	AA7	0
0	A55 AA55	KK KK	0

1	2	3	4
0 0	0 0	88A 888	0 0
0	0	33Q 33QQ	6622
666AA	99K	0	22J

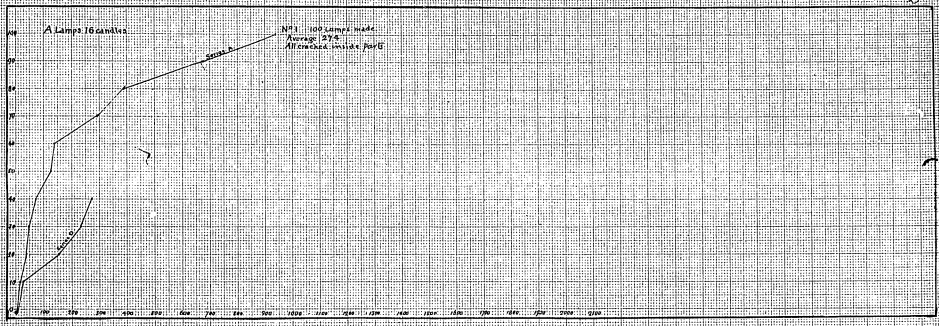
1	2	3	4
3 4 5 6.	Q Q 9	K K 7 7	3 flush
6 6	9 9 9	K K 7 7	
0	0	7 7 A	0
		7 7 A	
6 6 A	8 8 9	0	10 10 - 9 9
6 6 J J			
0	4 Fl.	2 2 8 8	K K
0			
3 3	0	0	0
3 3 3			
0	10 10 A	0	0
4 4 4	0	5 5 A	7 7
4 4 4			
10 10 K	9 9 9 10	0	4 Fl.
	9 9 9 10		
7 7 8	A A 5	0	0
	A A 5 5		
0	0	8 8 7 7	4 F
5 6 7 8	0	A	0
	0	A A	
A	K K	8	Q
A A 10 10	K K	8 8 4 4	
0	2 2 Q	K K	Q
	2 2 9 9	K K K	
9 9 A	0	K K	10 10
		K K 10 10	2 2 Q
10 10 K	K K	0	2 2 Q Q
J J 10 3 3	K K J J		8 8 9
5 5 A	0	2 2	2 2 10
0	10 10 K	0	0
0	A A	Q Q	0
	A A K K		

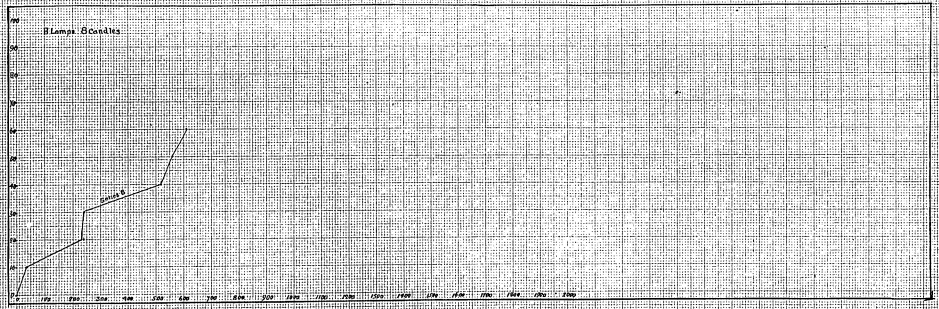
Fu
21



Charles Batchelor Notebook, Cat. 1381

This notebook contains graphs relating to lamp performance (ca. 1882-1884), to electric transmission costs (ca. 1886-1889), and to Charles Batchelor's stock holdings in various companies during the years 1889-1893. Graphs pertaining to non-Edison companies have not been filmed. The book contains 5 numbered pages followed by 11 unnumbered pages. Several pages have been cut out of the book.


A Lamps. 16 candles
No 1 100 Lamps made
Average 227.4
All cracked inside bulb
Series B
Series A


B Lamps. 8 Candles
Series B

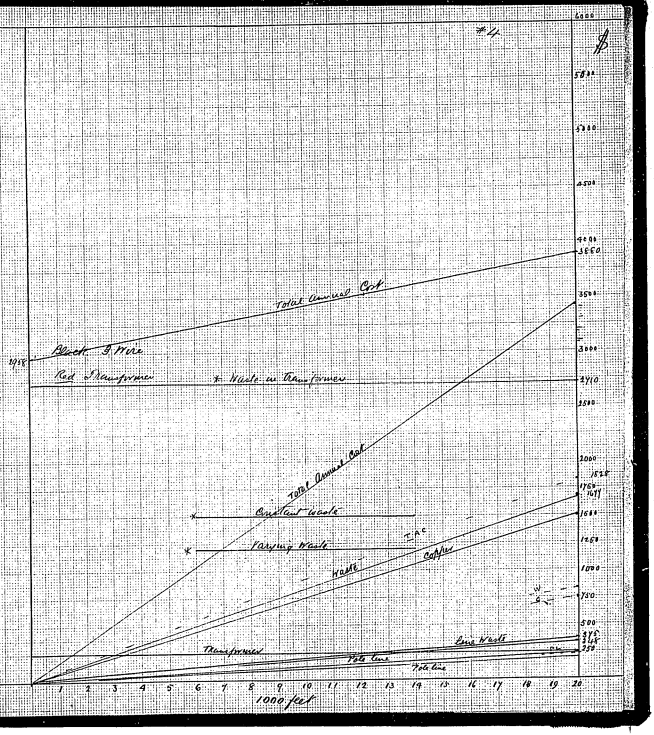
Cost of Transmission
of 660 Amperes (Max)
Average Condition of
Load per 1000 ft. Cap.

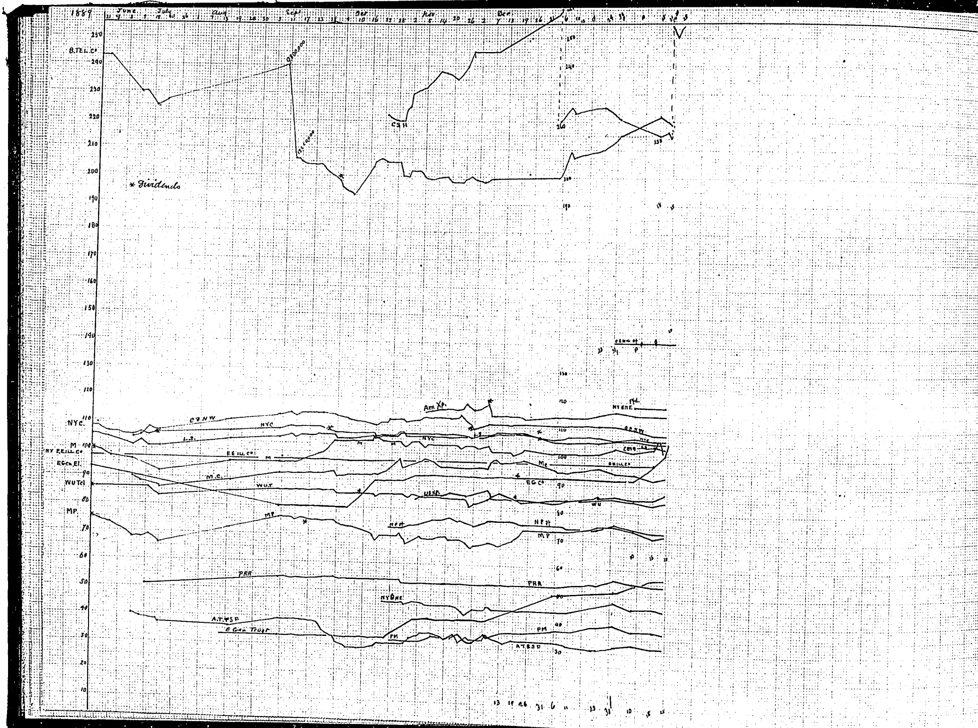
A. Three wire Bench.

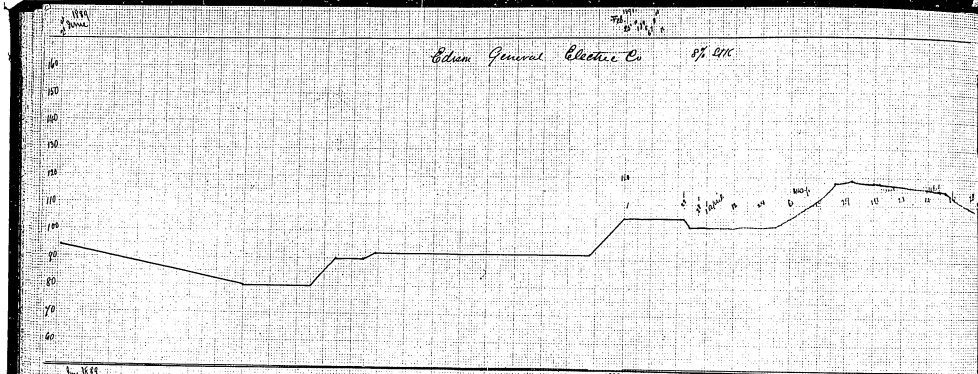
8000 ft. Pa. Lead-cad
Standard dynamo
32 Volt Cap. @ 1375 annual
Cost of 660 Amp. @ 2.16
per Amp. per annum
Cost of Transmission through
feeder
Income per Ampere of three
without cost of per Amp. for
@ 18.00

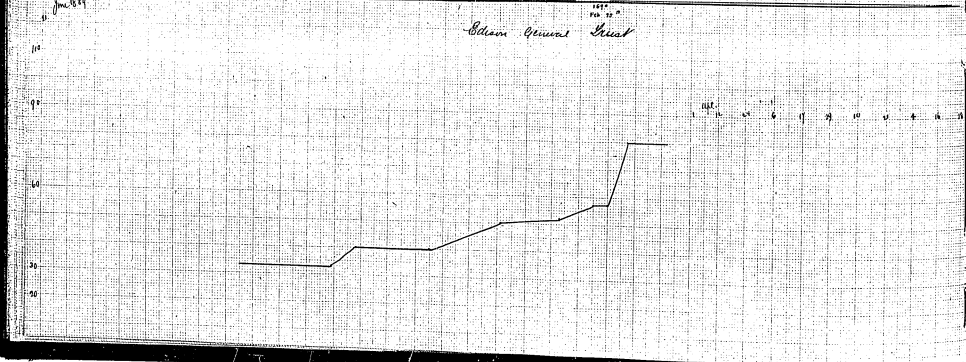
B. Double Three wire

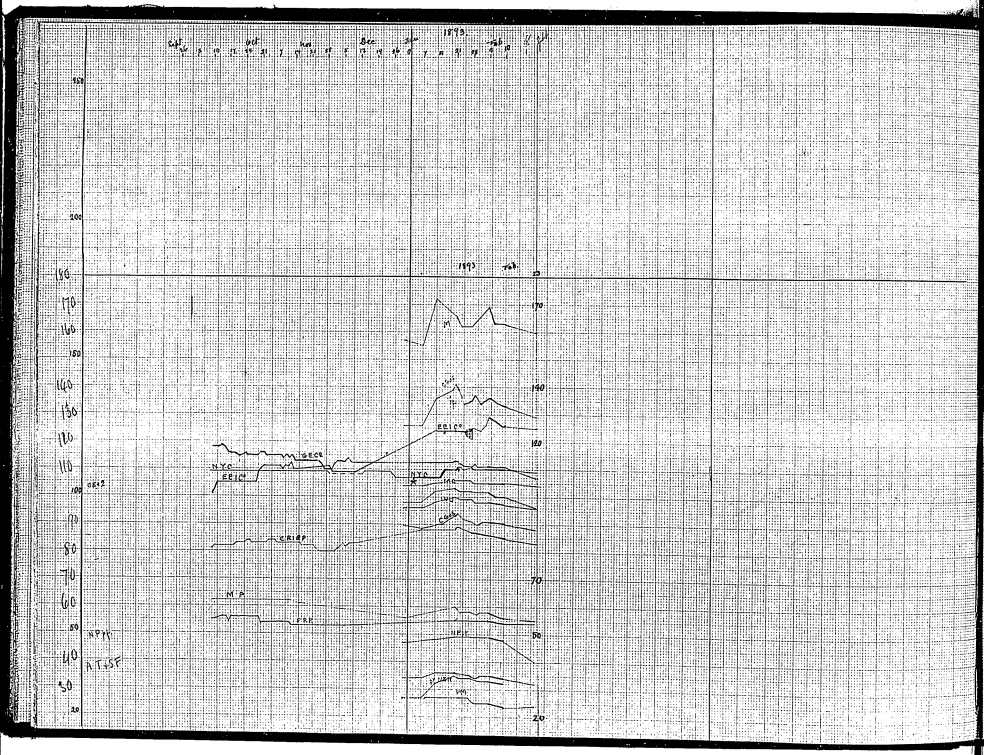
C. Transformer




1889
June
July
Aug
Sept
Oct
Nov
Dec
B.TEL.Co
* Dividends
NYC.
M
NY E.E.Ill.Co
E.G.E.El.
WUTel.
MP.
C&NW
NYC
L.S.
EE Ill. Co.
M.C.
WU.T.
MP
PRR
NYONE
A.T.&S.F.
E Gen Trust
PM
Am XP.


Edison General Electric Co
8% Div.
June 1889
Sept.
Nov.


Edison General Trust
Jan. 1889
Feb. 1889
Sept.


1893
1893 FEB.
N.Y.C.
EEICP
GECP
CHICAGO
M.P.
PBX
NPP
ATLSF
WASH
WIC
CHIC
NPP

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